ESSENTIALS
of
FIELD SANITATION

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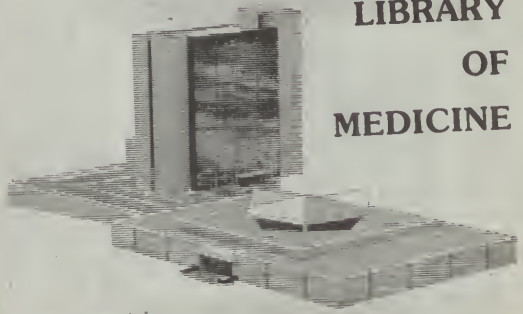

ESSENTIALS

of

FIELD SANITATION

for

THE MEDICAL DEPARTMENT UNITED STATES ARMY

Prepared by

DEPARTMENT OF MILITARY SANITATION

MEDICAL FIELD SERVICE SCHOOL

CARLISLE BARRACKS,

Carlisle, Pa.

ILLUSTRATED

Approved by The Surgeon General of the Army.

REVISED EDITION

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INTRODUCTION

This pamphlet contains information which will be helpful to the personnel of the Medical Department in that part of their work which has to do with the prevention of disease. This work will be of two kinds—first, that of preventing outbreaks of disease; second, that of controlling the spread of diseases which have started in spite of or in the absence of preventive measures.

Since soldiers live and work closely together and must go wherever and whenever military conditions require, certain diseases tend to occur more frequently in armies. This tendency is increased by the bringing together of large numbers of recruits from varied localities. On the other hand, the youth of the soldiers, their regularity of living habits, and the benefits of military discipline decrease the prevalence of many diseases.

Those diseases which most seriously interfere with the operation of armies in the field are the so-called communicable diseases. They cause more than one-third of the admissions to sick report for all causes and more than one-half the admissions, for disease only, in the United States Army during peace and this ratio is increased during war.

SECTION I.

COMMUNICABLE DISEASES

NATURE OF COMMUNICABLE DISEASES

Communicable diseases are those which are conveyed from one person to another. They are divided into groups as follows: (The grouping of communicable diseases as given below is based upon control measures applicable at the present time).

1. *Respiratory Diseases.* Those carried by discharges from the mouth, nose, throat, and lungs.

2. *Intestinal Diseases.* Those carried by discharges from the intestinal and urinary tracts.

3. *Insect-borne Diseases.* Those carried by insects.

4. *Venereal Diseases.*

5. *Miscellaneous Diseases.*

There are a number of preventable diseases which do not readily fall into the above groups. The more important ones are tetanus, rabies, scabies, and epidermophytosis.

The communicable diseases have many features in common although exceptions will readily come to mind.

1. They are caused by filterable viruses, bacteria or protozoan parasites.

2. They pass easily from person to person.

3. They occur more commonly during infancy, early childhood, and adolescence.

4. They have an acute onset and more or less rapid termination.

5. A well-marked seasonal variation in occurrence, is observed.

6. In many instances a temporary or lasting immunity is conferred by the first attack.

7. They many times occur in epidemic form.

8. It is a great probability that they are all preventable.

DEFINITIONS

A person who is actually ill with a disease is spoken of as a *case.*

In any given outbreak of a communicable disease, the first person known to have been sick is spoken of as the *primary case.*

A person who has been closely associated with the sick person is known as a *contact.*

A person who has been exposed to a communicable disease and is ill but in whom the symptoms and signs present are insufficient to warrant a diagnosis of the particular disease, is spoken of as a *suspect.*

A person who although not ill is giving off from his body germs capable of causing disease in others is known as a *carrier.* Such persons are very important sources of certain diseases, particularly typhoid fever, diphtheria, meningococcus meningitis, and septic sore throat.

One who if exposed to a disease is likely to acquire it it said to be *non-immune* or *susceptible* and one so exposed who is not likely to get the disease is said to be *immune* or *non-susceptible.*

During *isolation* a patient is removed from all contact with persons other than his immediate attendants and every precaution is taken to insure that infectious materials leaving his body are so treated as to render them harmless to others.

Isolation may be used in the handling of cases, carriers, and suspects. It is a very strict medical procedure requiring a thorough understanding of just what is to be done by all attendants of the patient.

Quarantine is the separation of the contacts of a case of communicable disease from those who have not been contacts. It may be applied to one or a number of persons. While in quarantine all usual activities may be carried on except those which will necessitate mingling with non-contacts, and a daily inspection is made by a medical officer for the purpose of detecting early cases of the disease. This constitutes the group or working quarantine which is generally practiced in the Army in the control of respiratory diseases. A quarantine continues for a prescribed time depending upon the incubation period of the disease.

The *incubation period* is the time between exposure to and the earliest symptoms of a communicable disease; it varies with different diseases and in different persons. (See table page 158).

The *transmitting agency* is the means whereby the material capable of causing disease is conveyed to the well person.

SPREAD OF COMMUNICABLE DISEASES

Diseases spread from person to person in three ways: by contact, through food (including water), and through insects. Contact is of two kinds, direct and indirect. During direct contact the sick and well persons are so close together that the infectious material can pass immediately from the one to the other. In indirect contact, the infectious material passes from the sick to the well person almost immediately through some intervening object or substance used by both.

The respiratory diseases are spread principally by contact, secondarily through food.

Intestinal diseases spread usually through food and water, occasionally by contact.

Insect-borne diseases are spread only by blood sucking insects.

Venereal diseases are spread almost entirely by direct contact during sexual intercourse.

Before an outbreak of a communicable disease can occur, certain conditions must exist. First, there must be a source of the disease, either a case or a carrier. Second, there must be present a number of susceptibles. Third, there must be a means of transmission.

Thus, three factors are fundamental to the spread of communicable diseases; namely, a source, susceptible individuals, and a means of transmitting the causative agent.

The relation of these factors is shown schematically in Fig. 1.

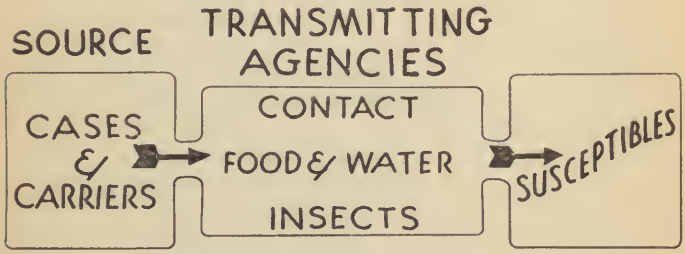

Fig. 1. Factors in the control of communicable diseases.

The control of the spread of these diseases can be accomplished by efforts directed toward any one or more of the three basic factors mentioned above.

Practically it is found that the knowledge of all the factors concerned in the spread of disease is many times slight. Frequently the avenue of transmission cannot be controlled satisfactorily. In a number of these diseases one attack does not protect against future attacks and in only a few is immunization a procedure of value.

By careful and constant attention to sanitation and personal hygiene general barriers against the spread of these diseases are set up. The methods used in controlling outbreaks of specific diseases are described in the following sections.

SECTION II.

RESPIRATORY DISEASES

These diseases occupy first place as a cause of admission to sick report in the Army. They are far more difficult to control than are the intestinal or insect-borne diseases. They spread by indirect contact through the media of air, hands, food, and mess equipment. The principal respiratory diseases are:

1. Measles.
2. Mumps.
3. Influenza.
4. Diphtheria.
5. Meningococcus Meningitis.
6. Scarlet Fever.
7. Pneumonia.
8. Pulmonary Tuberculosis.
9. Common Respiratory Diseases:
    a. Coryza.
    b. Acute Tonsillitis.
    c. Acute Nasopharyngitis.
    d. Acute Pharyngitis.
    e. Acute Laryngitis.
    f. Acute Bronchitis.
    g. Pleurisy.
10. Smallpox.
11. Septic Sore Throat.
12. Vincent's Angina.

CONTROL

The control of these diseases depends upon:

1. Their prevention.

2. The proper handling of an outbreak, the important measures of which are:

a. Early recognition of the first case and its prompt isolation in hospital.

b. Hospitalization or strict quarantine of suspects.

c. Group quarantine of contacts.

d. Hospitalization of carriers.

e. Attention to the proper ventilation of quarters.

f. Attention to the proper spacing of beds in sleeping quarters.

g. Proper handling of mess gear.

h. In the more important diseases daily inspections of the entire command to discover cases or suspects is essential.

i. Instruction in personal hygiene.

See Fig. 2.

Certain of these diseases warrant further consideration of their control measures.

Measles and mumps are more prevalent among recruits from rural than among those from urban populations.

Diphtheria and meningococcus meningitis are essentially carrier diseases. It is, however, not feasible in large military commands to attempt the detection of carriers. More important is the alleviation of overcrowding and, during times of mobilization, the establishment of detention camps in which to retain recruits for sufficient time to permit the development of symptoms of any diseases to which they may have been exposed.

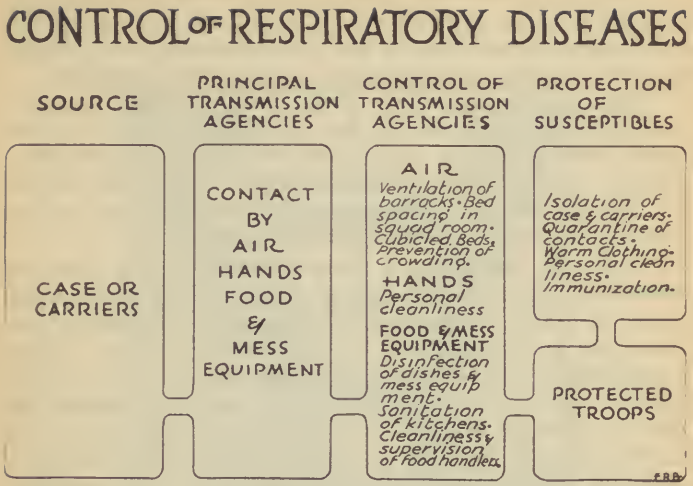

Fig. 2. Factors in the control of respiratory diseases.

Medical Department personnel whose duties require them to attend the sick should be routinely Schick tested and the positive reactors rendered non-susceptible by toxin-antitoxin or toxoid prior to exposure.

Influenza epidemics are of such explosive nature and spread so rapidly that effective control is most difficult. Group quarantine is of no practical value. Special attention to mess sanitation, including the personal hygiene of the mess personnel and the care of mess equipment, and the elimination of crowding are particularly important.

In controlling diphtheria, meningococcus meningitis, influenza and the common respiratory diseases moderate exercise in open air, exposure to sunlight, avoidance of undue fatigue and chilling, and allieviation of depressing environmental conditions are important factors in increasing and maintaining group resistance.

Smallpox prevention depends upon vaccination, which is required by Army regulations. However, should a case occur in a military organization, the most practical and reliable procedure would be revaccination of the entire command.

The use of unpasteurized milk and ice cream prepared from unpasteurized materials and the use of pastries such as cream puffs containing ingredients which have not been sterilized are important factors in outbreaks of septic sore throat.

The following information is of particular value in decreasing the incidence of respiratory diseases:

1. Proper *ventilation of barracks and quarters.* (See AR 40-205, par. 19.). Natural ventilation is easily and adequately obtained by opening windows at the top on one side of the room, and from the bottom on the other side (Fig. 3). Noncommissioned officers in charge of quarters should check the window ventilation several times each night. If troops are under canvas the sides of the tents should be rolled and the hoods opened if weather conditions permit. In temporary buildings provided with single sash, sliding windows provision should be made for such window openings for the entrance of air as the weather will permit and for air exits through ridge ventilators. In case the rooms have been ceiled there should be openings in the ceiling to permit the escape of air to the ridge ventilators. During sleeping hours there should be a flow of air through the rooms amounting to 1800 cu. ft. per hour per occupant. The air in sleeping quarters should have a movement easily felt on the back of the hand, the temperature should be between 64°F. and 70°F., and the air of the rooms should not seem stuffy or hot as one enters from outdoors.

2. *Proper bed spacing.* In barracks each soldier should have a floor space of 60 square feet and bunks should be placed head to foot. This permits six feet between the heads of the men. Tentage should supplement inadequate barrack space, assigning six men to a large pyramidal tent. If condi-

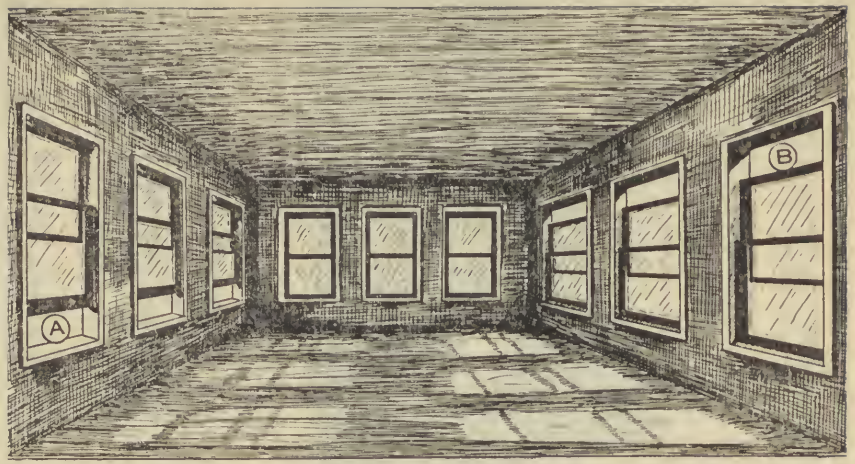

Fig. 3. Ventilation of squad room showing arrangement of window openings.

tions will not permit six feet between the heads of the men, head to foot sleeping with cubicles made from shelter halves and fixed on the beds or cots is necessary (Fig. 4). In hospitals cubicles may be constructed by hanging sheets on wires between adjacent beds.

Fig. 4. Cubicalization of canvas cot, using shelter tent half and pole.

3. *Prevention of overcrowding.* This is accomplished by proper bed spacing, occupying alternate seats at the mess hall and theater, minimizing close order drill, and limiting gatherings in the squad or day room by providing diversified entertainment. Squad rooms should have a capacity not in excess of 24 men.

4. *Barracks Sanitation.* (See AR 40-205, par. 19). Spitting on the floors, dry sweeping of the floors, careless coughing, sneezing and expectorating, and the use of drinking cups and towels in common must be prevented. An ample supply

of cuspidors containing 2% solution of cresol is important. Cuspidors should be cleaned daily. Bedding should be aired twice weekly.

5. *Chilling and fatigue.* The physical comfort of the men must be maintained by supplying sufficient clothing to prevent chilling and adequate bedding at night. They should not be subjected to prolonged exposure under unfavorable weather conditions.

6. *Mess Sanitation.* Sterilize all dishes (AR 40-205, par. 14). Each individual should use and clean his own mess gear. The mess personnel must be carefully observed for the early detection of symptoms of respiratory diseases.

7. *Recruits.* Incoming recruits should be kept apart from other troops until the time for the development of respiratory diseases has passed. This separation need not interfere with their training.

Rule of thumb for prevention and control of respiratory diseases:

1. Under ordinary conditions:
   a. Head to foot sleeping.
   b. 60 square feet of floor space per man.
2. During respiratory season (November to April):
   a. Head to foot sleeping.
   b. 60 square feet of floor space per man.
   c. Recruits in addition to (a) and (b) must sleep with shelter half cubicles.
3. Threatened or actual epidemic of respiratory diseases:
   a. Head to foot sleeping.
   b. 60 square feet floor space per man.
   c. Cubicles for everyone.

References:

AR 40-205.
AR 40-220.
Military Preventive Medicine (Army Medical Bull. 23).

SECTION III.

INTESTINAL DISEASES

The control of this group of diseases is the Army's most noteworthy achievement in the field of preventive medicine. Their causes and modes of transmission are well understood in theory and their prevention is attainable in practice. The principal intestinal diseases are:

1. Typhoid and paratyphoid fevers.
2. Cholera.
3. Dysentery.
   a. Bacillary.
   b. Amoebic.
4. Common diarrhea.
5. Helminthic infestation.
6. Food infection. (Salmonella group of organisms).
7. Food intoxication. (Botulism).

Intestinal diseases, except uncinariasis, are transmitted from person to person through indirect contact by contaminated food and water.

METHODS OF CONTROL

The control of these diseases depends fundamentally upon their prevention and the following measures are essential:

1. Purification and protection of water supplies.
2. Properly inspected and protected food supplies.
3. Proper waste disposal.
4. Fly control.
5. Immunization.
6. Sanitation of messes.

Should cases occur, early diagnosis, isolation, concurrent and terminal disinfection, with rigid enforcement of the rules of personal hygiene will, in addition to the above measures, greatly lessen the probability of an epidemic developing. (Fig. 5).

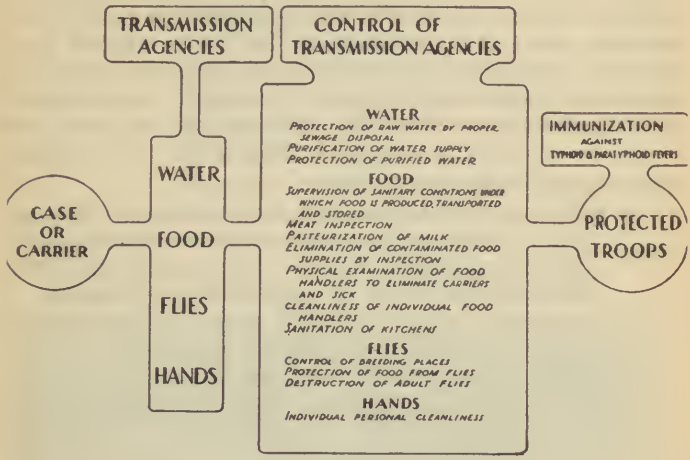

Fig. 5. Factors in the control of intestinal diseases.

PURIFICATION OF WATER

Purification of water. Water requirements vary under different conditions. Individuals seldom can maintain good health under working conditions or in campaign with less than one-half gallon of drinking water per day. Troops on field service ordinarily use 2-5 gallons of water per person per day for all purposes. In semi-permanent camps the per capita consumption varies between 20 and 40 gallons per day. Practically, all sources of water in the field should be con-

sidered as contaminated and not used until properly treated. Some sources are, however, better than others and it is a Medical Department responsibility to recommend the most nearly satisfactory source as well as to supervise the method of treating the water. A water reconnaissance is necessary to select the best source. The important factors to be considered in such a selection are: the type of water, (ground or surface), location and availability, quantity and quality, and probable extent of contamination. The water decided upon should be as clean as possible and the heavier suspended organic matter removed by straining or settling. A pit dug 4-5 feet from the edge of a stream or pond and 3-4 feet below the stream level makes a suitable settling basin. In the field, water is purified by two methods:

a. Boiling is the safest method but is undesirable because of the flat taste it gives the water and because of the lack of containers for other than small quantities. Five minutes boiling is required for sterilization.

b. Chlorination is the method of choice and may be carried out in the water sterilizing bag (Lyster bag), in water carts, or small reservoirs.

1 Water sterilizing bag (Fig. 6). The technique is as follows:

a Fill the bag, suspended on a tripod, to within four inches of the top.

b Draw a small quantity of water through one of the faucets into a canteen cup.

c Break an ampule of calcium hypochlorite into the canteen cup, stir with a clean stick until a thin paste is formed, then fill the cup two-thirds full of water.

d Empty the above solution into the water bag and stir thoroughly with a clean stick long enough to reach to the bottom.

e Draw about 1/3 canteen cup of water from each of the faucets and pour it back into the

water bag.

f Wait ten minutes, then wash out one of the faucets by allowing a small amount of water to run through onto the ground. Fill a clean canteen cup two-thirds full of water from the same faucet.

g Add one C.C. (15 drops) of orthotolidine testing solution (See page 153) to the water in the cup. Wait two minutes and note the color produced. Below is a guide for reading the reaction between free chlorine and orthotolidine:

No color—Insufficient chlorine. Add more calcium hypochlorite.

Canary Yellow—Insufficient chlorine. Add more calcium hypochlorite.

Fig. 6. Water sterilizing bag.

Deep Yellow—Satisfactory chlorination, being about one part per million (ppm) of chlorine.

Orange Red—Over chlorinated. Add more water and retest.

Bluish Green—Alkaline or hard water. Add few more drops of orthotolidine to get a correct color reading.

h Allow to stand thirty minutes after satisfactory chlorination has been accomplished. The unpleasant taste of over-chlorinated water is diminished by allowing it to stand several hours before using. It is a good plan to chlorinate water in the evening for the next day's use.

Fig. 7. Animal drawn water cart, 110 gallon capacity.

2 Water cart method. Chlorination may be done directly in the water cart, either animal drawn (capacity 110 gallons) or motor trailer (capacity 250 gallons). At least three tubes of calcium hypochlorite are necessary for the former and eight tubes for the latter. The exact amount needed can be determined by the ōrthotolidine test. These carts must be thoroughly cleaned at frequent intervals (Fig. 7 and 8). At the present time most units are supplied with several 10 gallon water cans instead of water carts as standard equipment for the transportation of water. Chlorination of water in these water cans is not practical.

Fig. 8. Trailer water cart, 250 gallon capacity.

3 Small reservoir. As water requirements become greater, the method of purification described above becomes difficult to apply. In semi-permanent camps using 4000 to 10,000 gallons of water per day for 200 men, pipe lines, pumps and reservoirs become necessary and

sterilization of such quantities of water are not easily accomplished with the means at command. In large municipal water supplies, liquid chlorine is almost universally used as the sterilizing agent and its application requires the use of highly complicated and expensive apparatus. Many small cities, however, chlorinate water with relatively simple apparatus such as a drip chlorinator. When there is a continuous even though varying flow of water through a treatment plant simple chlorinating apparatus can easily be used but when the flow is intermittent difficulties arise. In such instances a given quantity of water may be pumped into a reservoir and chlorinated by addition of the requisite amount of calcium hypochlorite. After sterilization has taken place, the water may then be pumped to an elevated tank for distribution by gravity to the camp. See Fig. 9. Such a reservoir might be filled from a small stream or flume, in which case the water could be chlorinated in the stream by use of a simple drip chlorinator. A drip chlorinator may be improvised by the use of two small wooden barrels the interiors of which are painted with mineral bituminous paint, one barrel to be in use while the hypochlorite solution is being prepared in the other. The ordinary calcium hypochlorite or bleaching powder contains 33-1/3% available chlorine when freshly prepared but is an unstable substance so that the supply received may contain but little chlorine. There are hypochlorites available, however, and now recommended for use by the Surgeon General which contain well above 60% available chlorine, are very stable and easily miscible. Bleaching powder tends to form small hard lumps when placed in water. In pre-

Fig. 9. General outlay of water supply system, semi-permanent camp.

paring a hypochlorite solution just sufficient water should be added to the powder to permit the easy formation of a smooth thin paste which is then diluted as required and placed in the chlorinator. Twenty-five pounds of ordinary bleaching powder added to 1,000,000 gallons of water gives one part per million of chlorine. If 4000 gallons of water is to be chlorinated 1/10 pound of hypochlorite is sufficient. A drip chlorinator may be used satisfactorly in a small stream, the size of the containers and strength of solution being determined by the rate of flow of the stream. In case water is so turbid as to make it unsatisfactory for use, it may be clarified by allowing it to stand for some time in a reservoir and clarification may be hastened by the addition of chemicals. Alum, lime, and soda ash are used for this purpose.

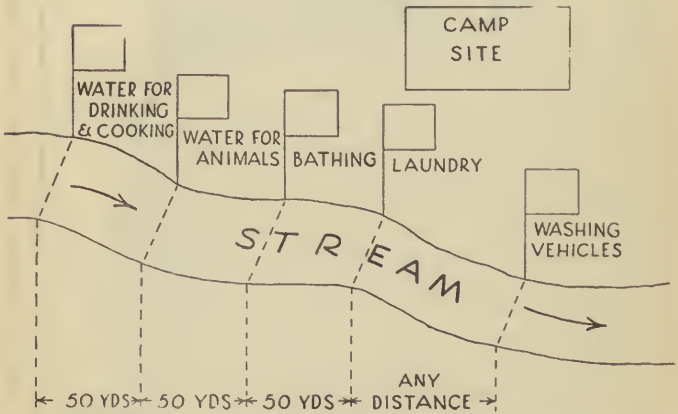

Fig. 10. Protection of water supply by proper use of stream from which water is taken for various purposes.

Protection of Water Supply. This includes both the raw and the treated water. The source should be guarded; if a stream it should be flagged as indicated in Fig. 10. Contamination from latrines and kitchen pits is prevented by placing them so that drainage is away from the water source (Figs. 9 and 10). The treated water in the sterilizing bag is protected by the use of a cover and by preventing withdrawal of water from it except through the faucets, and by forbidding the use of faucets as drinking fountains. Sterilized water in carts, trailers, or other containers must be protected from contamination.

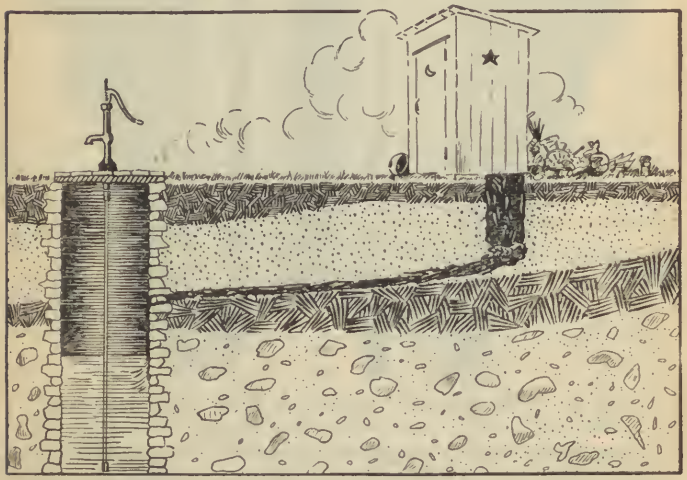

Fig. 11. Pollution of a well by seepage from a pit privy.

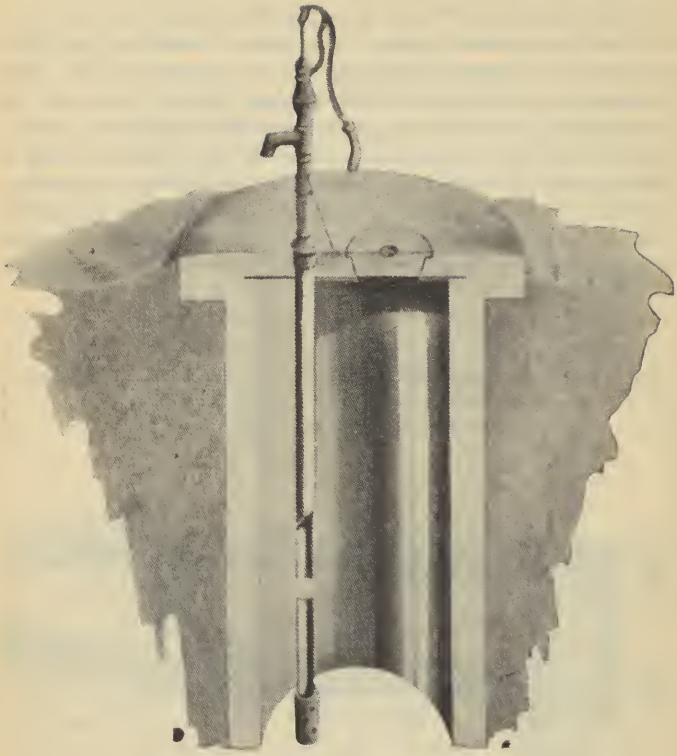

Fig. 12. Well properly protected from contamination.

Samples of water should be submitted to laboratories for bacteriological examination at sufficient intervals to assure a satisfactory control of the supply. Samples are collected in glass stoppered sterilized 100 cc. bottles. Prior to sterilization the stopper and neck of the bottle are covered with

a piece of cloth securely fastened on with string or wire to prevent contamination and leakage. In obtaining a sample from a pump or faucet the water should be allowed to flow some little time in order to be certain that a representative sample is obtained. The fastening wire or cord holding the cover of the bottle is loosened and the stopper withdrawn by grasping it without displacing the cover. The stopper is held in the hand while the sample is being taken, thus guarding against contamination. The sample is taken by holding the bottle in the stream of flowing water, the stopper reinserted and secured in place by fastening the cover. In sampling from a stream, the bottle is immersed so as to secure water from a few inches below the surface. Samples of water for bacteriological examination should be gotten to the laboratory within from 12 to 72 hours depending upon the known or suspected extent of contamination.

INSPECTION OF FOOD SUPPLIES

Inspection of Food Supplies. Food inspections in the field include the local inspection of meats, canned goods, poultry, eggs, fish, dairy products, and green vegetables. Quartermasters will have "Federal Specifications" stating the quality of food to be supplied.

1. Meats. Army regulations require the procurement of meat previously inspected by the Bureau of Animal Industry and all meat so passed bears the stamp B.A.I. The important factors in the local inspection are:

a. Color. Choice fresh meats should have the following color: beef, bright red; veal, pinkish brown; mutton, dark pink or red; lamb, light pink; pork, light pink.

b. Detection of decomposition, superficial and deep. A wet, slimy, or mouldy surface, or softened areas are usually indicative of early surface spoilage.

Deep tissue decomposition generally occurs in the large joints or about the long bones. A meat trier is

passed down to the bone or joint or the area is exposed by an incision and the odor of putrefaction or souring is given off from the trier or the meat if decomposition is present. Frozen meat is hard, firm, and dry. Evidence of deep tissue decomposition is tested by means of a wood auger, which, if the meat is well frozen, will cut a clean hole. The ammonia test (Eber test) will detect deep tissue decomposition and is carried out by placing 2 cc. of reagent (1 part concentrated hydrochloric acid, 1 part ether, and 3 parts absolute alcohol) in a clean test tube and shaking. A small piece of meat to be tested is lowered to within ¼ inch of the surface of the reagent. If ammonia is present, the white ammonium chloride fumes will appear around the specimen. Frozen meat should be warmed to room temperature before testing.

Good, high grade meat is dry, firm, of normal color and free from abnormal odors. The results of the inspection will determine whether the meat is passed or rejected. Outright rejection should be recommended if the unsoundness involves any considerable proportion of the carcass or cut, and likewise in all doubtful cases.

Partial rejection with elimination of unsound portions by trimming of the slime and excision of small bruised areas, should be recommended only in case the meat is in possession of the Quartermaster or the organization using the meat. If the inspection is made prior to purchase, total rejection of all meat showing unsoundness in any degree should be recommended.

Cured meat products are inspected by examining about 10% of the pieces in the shipment, if the quantity is large. If unsound meat is found each piece in the lot should be examined. The inspection includes an examination for bruises, mutilation of

any kind, discoloration, soft white spots, slime, mould, infestation with insect larvae, sourness, rancidity, or evidence that the meat has been trimmed to remove unsound portions. Deep tissue decomposition occurs in the bone marrow or adjacent to bones and joints. Testing is by use of a meat trier and noting the odor.

Cured meats showing deep tissue decomposition, insect infestation, multilation, or white areas due to improper smoking should be rejected. Slight degrees of mould or slime may be removed by washing the surface with diluted vinegar.

The inspection of pork requires special attention. The Taenia solium (pork tapeworm) passes its larval stage in the hog and the encysted forms are found in the pork muscle and called Cysticercus cellulosae. Encysted forms ingested by man develop into adult tapeworms and may cause death. Such infested pork is speckled with the encysted forms, is called "measly pork" and should be rejected. Meat inspection is not an adequate safeguard against the transmission to man of Trichinella spiralis, contained in pork, and cooking alone is the only adequate measure of preventing human infestation.

2 Canned foods, including meat, should be inspected locally. Defective cans are classified according to the nature of the defects as leakers, swellers, or springers. A.R. 40-2200.

A leaker is a can presenting a defect through which air may enter or the contents escape. If the defect is small, leakage may be indicated only by the removal of the vacuum and the disappearance of the concavity in the ends or sides of the can.

A sweller is a can which contains gas in sufficient quantities to produce bulging or distention of the sides or ends. The gas is usually due to contamination with gas producing organisms resulting from

incomplete sterilization or infection subsequent to sterilization.

A springer can differs from a sweller only in that the accumulation of gas within the can is sufficient to cause a disappearance of the normal concavity from one end or side. External pressure on the flattened or bulging side causes the other end or side to flatten or bulge.

All leakers, swellers, and springers should be rejected. Black discolorations on the inside of cans are due to chemical reaction between the contents of the can and the metal. It is not a cause for rejection. The presence of Bacillus botulinus in canned foods is noted by its characteristic foul odor. Such foods should not be tasted.

3. Poultry, Eggs, and Fish.

A. R. 40-2185, 2190.

a. Poultry should be rejected if inspection reveals decomposition or bruising of the tissues, hemorrhagic or discolored areas, fractures, parasitic invasion, other evidences of diseases, or for esthetic reasons.

b. Eggs are inspected for freshness, soundness, cleanliness of the shell, color, and size. Candling and breaking are used to test the freshness or soundness of eggs. In candling the unsoundness is indicated by mixing of the white and the yolk, adherence of the yolk to the shell, blood rings, heavily mottled or abnormally colored yolks, spots of movable air, discolored whites, or foreign bodies. Unsound eggs should be rejected. The general condition of a lot of eggs may be determined by breaking a certain number selected at random and if any considerable proportion are unsound the entire lot should be rejected.

c. Fish that are fresh and sound present the following characteristics:

1. The gills are bright red with no abnormal odor and are usually closed.
2. The eyes are prominent and the cornea is transparent.
3. The scales are adherent.
4. The skin is free from malodorous slime and not discolored.
5. The flesh is firm and only transient indentations can be made by pressure with the fingers.
6. The body is stiff and the tail rigid.
7. The carcass sinks in water.

The lack of any of the above characteristics or infestation with parasites or fungi calls for rejection.

4. Dairy Products. Milk issued to troops for beverage and cooking should be grade "A" pasteurized. When this is not obtainable, and this will be true in many places, grade "B" pasteurized milk may be used. The use of bulk milk should be discouraged and the use of raw milk should not be countenanced. If grade "A" or "B" pasteurized milk is not available, evaporated milk should be used.

Samples of bottled milk for bacteriological examination should be submitted to laboratories at frequent intervals. Samples should include one bottle (pint) selected at random from the milk plant immediately after pasteurization and one bottle of delivered milk. They should be packed in ice immediately and transferred to the laboratory. If laboratory facilities are not available locally the following procedure should be followed. Request from Corps Area laboratory special milk specimen mailing containers. Use a sample of one quart of milk and pour it 25

times between sterile containers. Then add 1 cc. of commercial formalin to the quart of milk and agitate thoroughly. From the sample fill the specimen bottle flush with the lower end of the stopper. Secure the stopper by binding the muslin cover in place with copper wire. Test for leakage. Label the specimen furnishing the following information: station from which sent, date of collection, nature of specimen, specific examination required, name of dairy from which milk was obtained, and the word "formalinized." Pack securely in the mailing case with absorbent cotton and mail to Corps Area Laboratory (AR 40-310).

Local milk inspection may, at times, include the inspection of dairies. Under such conditions the following points are most important. The herd should be tuberculin tested. The barns should be well ventilated, providing at least three square feet of window space and 500 cubic feet of air space for each stanchion. Manure must be removed and disposed of in such a manner as to prevent fly breeding. All milking utensils must be of non-absorbent material, in good repair, and sterilized before using. The milk must be cooled within one hour after milking, to 50°F. and maintained at or below that temperature until delivery to the pasteurizing plant. A. R. 40-2230.

Inspection of pasteurizing plants require in addition to a thorough knowledge of the pasteurizing process an adequate understanding of the equipment, its construction, installation, and operation. Pasteurizing plants should have in satisfactory operation, vats or holders in which the temperature of the milk is raised to 145°F. and held there for 30 minutes, automatic devices for registration of the pasteurizing temperature, coolers wherein the milk may be rapidly cooled to 45°F. after pasteurization, automatic bot-

tling and capping machines, automatic bottle washers, and facilities for cleansing and sterilizing all parts of the pasteurizing equipment with which the milk comes in contact. All milk bottles should be sterilized before being filled and all pasteurizing equipment sterilized immediately before being used.

5. Green vegetables are unsuitable for food if grown in soil fertilized by human excreta. The use of poisonous sprays may render the food unsafe for human consumption. Likewise, worm infestation is a cause for rejection. All leafy vegetables which are to be eaten raw should be thoroughly washed in running water.

PROTECTION AND STORAGE OF FOOD SUPPLIES

Protection and Storage of Food Supplies. Surplus and reserve food supplies should be protected from insects such as flies and roaches, from dust and dirt, and from rats and mice. Perishable foods should be stored at a temperature which will inhibit the growth of moulds and bacteria. For camps of less than one week's duration, storage devices for preservation of food are not necessary. For longer periods

1. In temporary camps food may be stored in watertight containers and immersed in springs or streams, care being taken to prevent contamination . Food may be buried below the surface of the ground where the temperature is lower, lining a pit with burlap, and placing boards on the bottom. In addition food containers suspended from trees or tripods and underground ice boxes provide satisfactory means of protecting and storing food.

   A suspended food container, (Fig. 13), consists of a screened box that permits free circulation of air but prevents contamination by insects. The cooling effect is increased by wrapping the box in burlap

which is kept damp. Fresh meat, bottled milk, and vegetables may be temporarily stored in such a container. It should not be used where the air contains any considerable amount of dust.

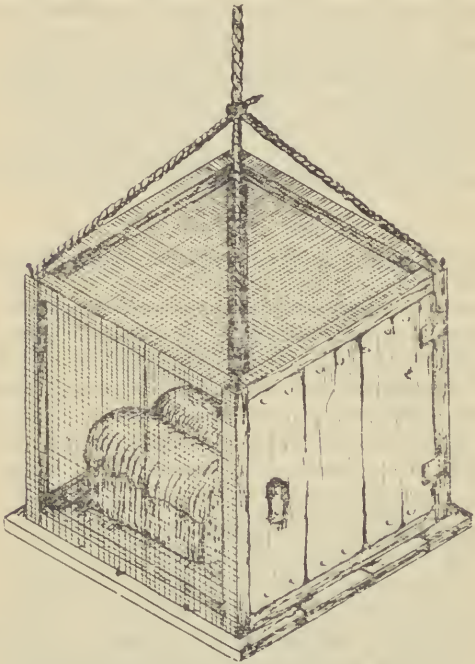

Fig. 13. Suspended food container.

Underground ice box or cooling box (Fig. 14). This simple device consisting of a double walled box, may be made by placing one packing box within a larger one, sunk into a pit in the ground so that the outer lid is slightly above the surface of the ground.

A space three to six inches wide, filled with sawdust, grass, hay, or straw separates the outer walls and the two bottoms. Two lids are necessary, one for the inner and one for the outer box. A drainage ditch should be dug around the box and a drain pipe should lead through the bottom of the box to a small soakage pit below. A box four feet long, three feet wide, and three feet deep, inside measurements, has sufficient capacity for the average company mess. If ice is available, an ice compartment should be constructed at the end containing the drain pipe. Also the box may be used above ground as an ice box. The cooling effect is increased by dampening the packing material between the walls or wetting down the earth around the box. To facilitate cleaning, the inner box should be easily removable. Meat, milk, vegetables, or other perishable foods may be stored in such an ice or cooling box.

2. In semi-permanent camps fresh or cured meats, milk and vegetables should be kept in underground storage rooms constructed similar to an old-fashioned root-cellar (Figs. 15 and 16). The floor consists of well tamped earth, or boards may be used. The walls should be boarded. Ventilation is secured by windows at the ends or an outlet through the roof. Vegetables should be kept in vegetable bins (Fig. 17). The bins are made of spaced slats to permit the circulation of air. The bottom should slope sufficiently to permit the older vegetables to be used first.

   Canned goods should be kept in storerooms adjacent to kitchens. Bread boxes, which permit aeration of the contents, should be used.

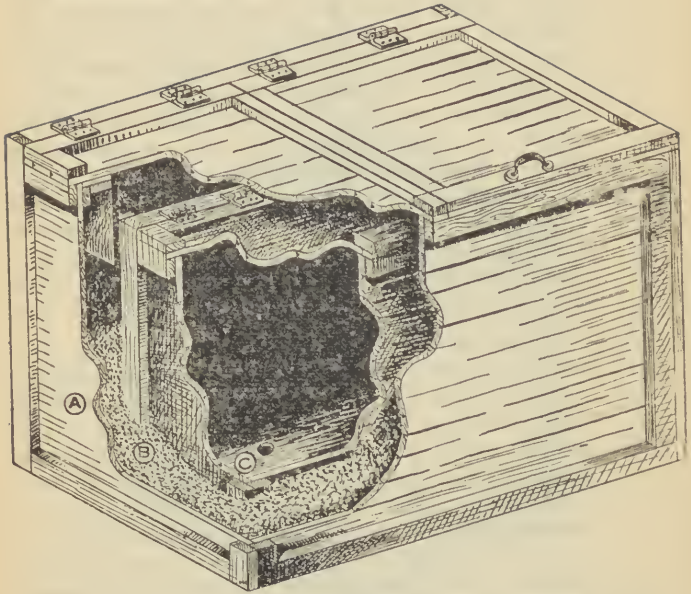

Fig. 14. Underground ice or cooling box. A-Outer wall. B-Insulating material. C-Inner wall.

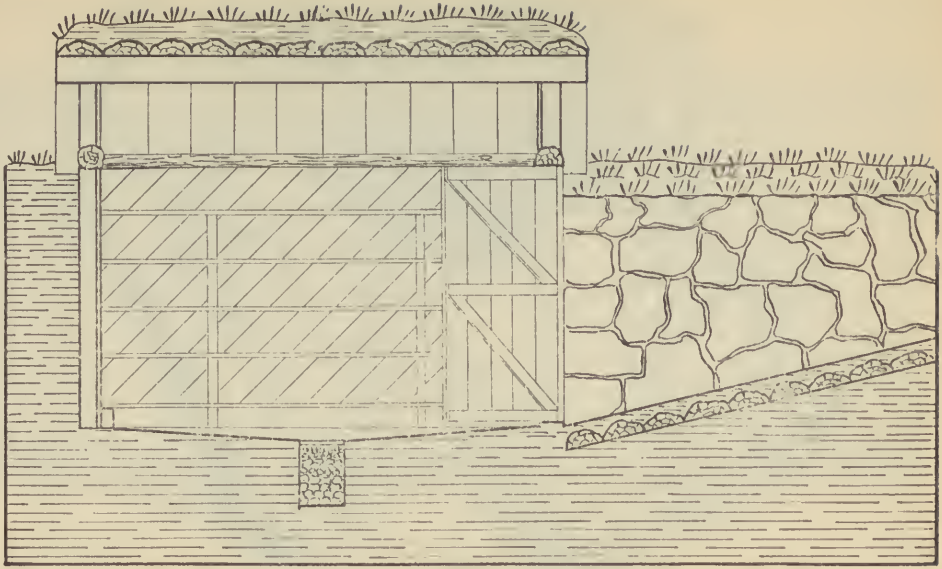

Fig. 15. Underground stcre room, longitudinal section.

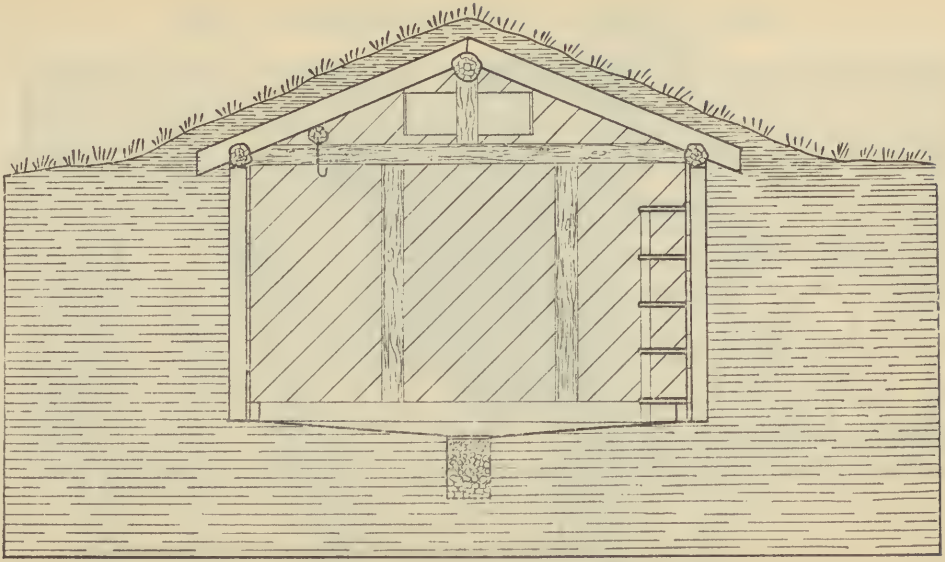

Fig. 16. Underground store room, cross section.

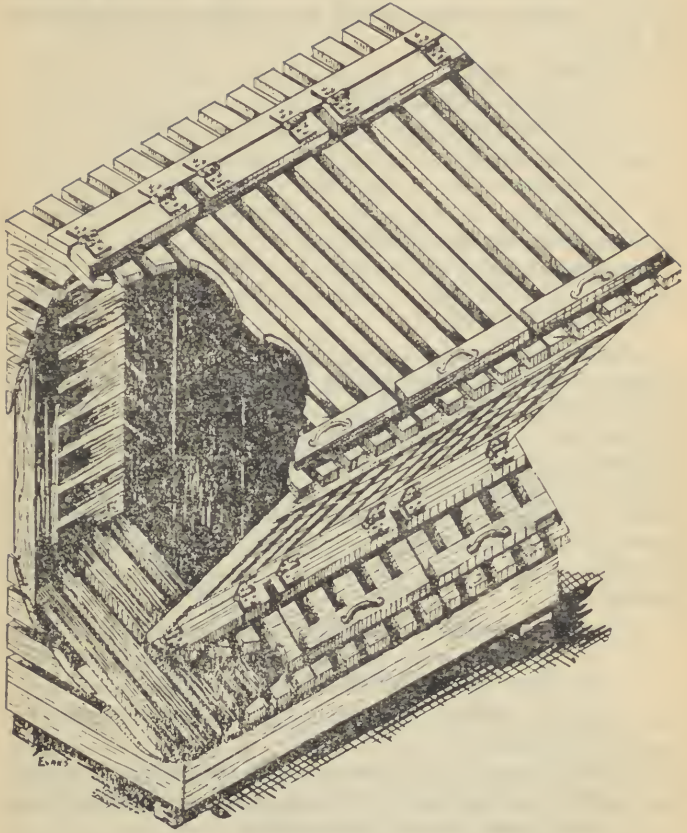

Fig. 17. Vegetable bin.

In relation to the spread of intestinal diseases the disposal of waste materials should be considered in the following order:

a. Human waste.
   Excreta—solids, liquid.
   Bath water.
b. Kitchen waste.
   Liquid.
   Solid.
c. Animal waste (manure).
d. Rubbish.

HUMAN WASTES.

Human wastes play a most important role in the transmission of intestinal diseases by the introduction of excreta from cases or carriers into food and water either through the medium of contaminated hands, flies, or by direct contact with excreta. The harmful effect of improper disposal of human wastes tends to increase in bivouacs and temporary or semi-permanent camps where no water carriage system of sewage disposal is available. Important general principles in the disposal of human wastes under such conditions are:

a. Latrines should be company installations maintained by the personnel of the company concerned. The Medical Department functions in a supervisory capacity in matters relative to the sanitation of such installations.
b. Latrine seats should be provided to accommodate 8% of the command at one time, each man being allowed two lineal feet of latrine space.
c. Latrines should be fly proofed.

The types of latrines used for temporary and semi-permanent camps differ in construction but their care is similar.

Temporary camps. Straddle or *trench latrines* are installed for troops in bivouac or in camps for less than one week. This latrine is constructed by digging a trench one foot wide, eighteen inches deep and 8-10 feet long. The earth removed should be piled at one or both ends and used by each man to cover his excreta (Fig. 18). Boards placed along the edges provide better standing. On the march, straddle trenches are constructed at the noon halt and at each bivouac. At other times on the march, each person should dig a small hole in the ground, deposit his dejecta and cover it with earth. In temporary camps, the straddle trench is used also as a urinal.

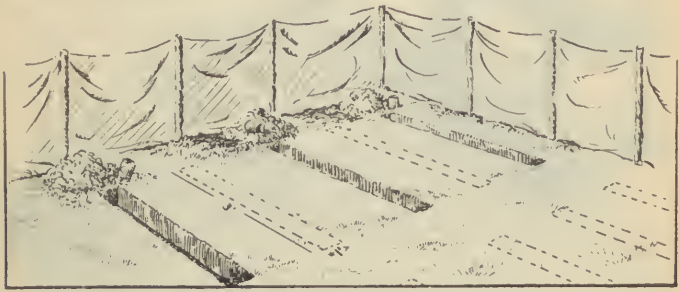

Fig. 18. Straddle trench latrine.

Semi-permanent camps. When troops are in camp one week or longer, deep pit latrines and urinal troughs or urine soakage pits are constructed. If the character of the soil does not permit the digging of deep pit latrines, pail latrines may be used. They may also be used in camps of a more permanent nature.

The *deep pit latrine* is used in conjunction with the standard Quartermaster latrine box, the width and length of the pit being governed by the size of the box. The latrine is dug 8 feet long, 2 feet wide, 4 to 10 feet deep, depending upon the character of the soil and the length of time the latrine is to be used. The standard latrine box fits over such a pit and earth should be packed about the bottom and ends of the box. A company of 200 men would require 32 feet of latrine space (4 standard latrine boxes). (Fig. 19).

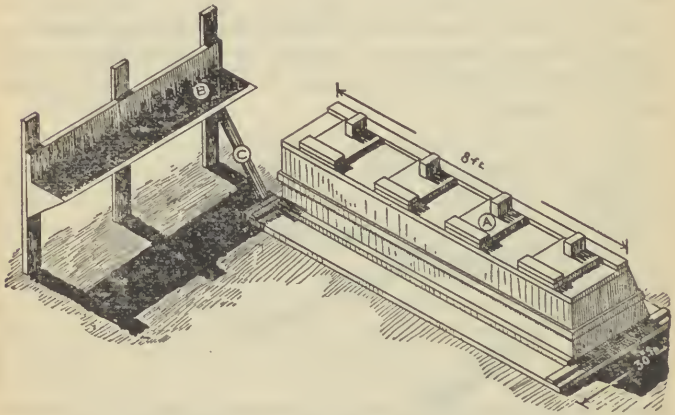

Fig. 19. A-Standard latrine box. B-Trough urinal. C-Pipe leading into latrine pit.

Pit latrines must be fly proofed to prevent access of flies to fecal material and to prevent the escape of larvae in case flies have gotten into the pit and breeding taken place. Flyproofing is accomplished in the following manner. An area 4 feet wide surrounding the pit is excavated to a depth of 6 inches. This area is then covered with burlap, soaked in crude oil, which hangs down the walls of the pit to

a depth of 18 inches and is turned down 4 inches into the ground at the outer borders of the area. The earth is replaced, tamped down and more oil is added. If burlap is not obtainable, oil alone may be used and if oil is not available, the earth may be hardened by moistening with water and tamped. (Figs. 20 and 21).

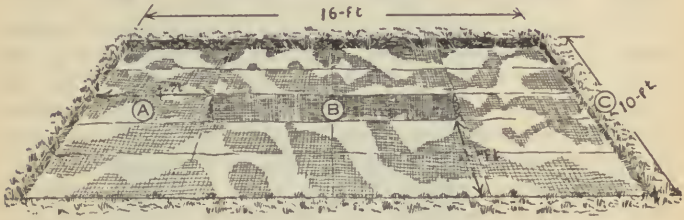

Fig. 20. Method of flyproofing latrine pit. A-Oil soaked burlap extending completely around pit. B-Opening of pit. C-Side wall of excavation in which burlap is placed.

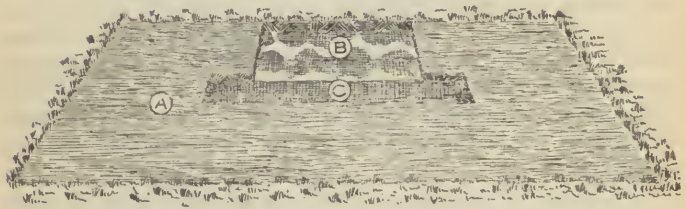

Fig. 21. Method of flyproofing latrine pit with oiled burlap. A-Layer of earth replaced and tamped down over burlap. B-Oiled burlap exposed before replacement of earth. C-Opening of pit.

The *urinal trough.* A urinal trough drains into the deep pit latrine and is included within the latrine enclosure. It is constructed from tin, galvanized iron, or wood; if from wood it should be lined with tar paper. The trough should

be U or V shaped and 5 feet in length (Fig. 19). If the latrine pit is in ground having poor absorbing qualities, urine may better be disposed of by means of urine soakage pits.

Urine soakage pit. This consists primarily of a pit in the ground 4 feet square and 4 feet deep, which is filled with pieces of broken rock, flattened tin cans, brick, or broken bottles. Two shafts placed at opposite sides of the pit provide ventilation. The shafts are made of 4 inch boards nailed in the form of a square with numerous holes bored in the sides. They extend from 6 inches above the top of the pit to within 6 inches of the bottom and the top of the shaft is screened. The ventilating shafts assist in the maintenance of aerobic conditions within the pit. Urinals made of 2-3 inch iron pipe are placed in each corner of the pit, eight inches below the surface and 30 inches above. A tar paper funnel containing grass or straw is placed in the upper end of each pipe (Fig. 22). Important precautions in the proper operation of such a soakage pit are: the changing of the grass or straw in the funnels daily, changing funnels weekly, keeping the pit surface free from debris, spraying the inside of the funnels and pipes with 2% cresol daily and prohibiting the use of crude oil. Such a pit should serve 200 men indefinitely. When it is closed the shafts and pipes should be removed and cleaned and the pit covered with dirt and sod. The soakage pit may receive urine from a trough urinal located within the latrine enclosure, the pit being outside the enclosure.

Location of latrines. Latrines should be 100 yards from any company mess or any well or spring, and at the end of the company street or on one flank at the rear of the tents. If nearby ground water supplies are being used for drinking or cooking, the latrines should be so situated as to prevent drainage into the water source.

Care of Latrines. Latrines must be kept clean and free from odors and flies. Crude oil or a mixture of crude oil

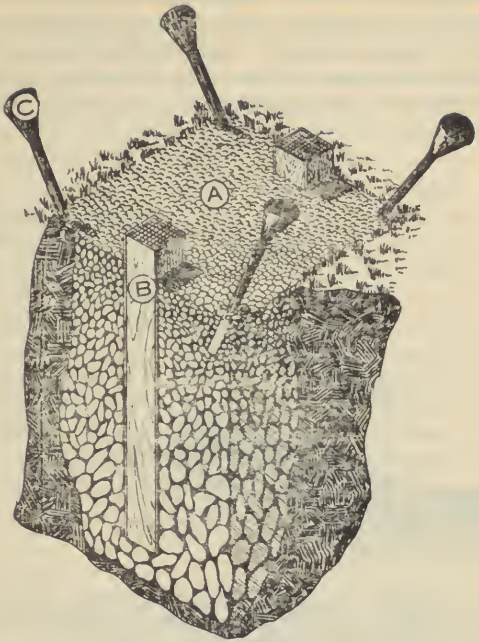

Fig. 22. Urine soakage pit. A-Rocks filling pit. B-Ventilator shafts. C-Pipe urinals.

with fuel oil or kerosene applied to the interior of pits and boxes is of value in eliminating odors and repelling flies. Special attention must be given to the cleanliness of urine troughs. The burning out of latrine pits is not advisable since it does not accomplish incineration of excreta and does interfere with the measures taken for prevention of fly breeding.

a. A latrine orderly should be on duty throughout the day.

b. The contents of the pit, the sides of the pit, and the interior of the box should be sprayed daily with crude oil, using

a knapsack spray. The box should be scrubbed daily with soap and water and twice a week the seats should be scrubbed with 2% cresol solution. Fig. 23 illustrates a brush to be used for this purpose. The seats should be dried after cleaning. The urine troughs should be scrubbed daily with soap and water.

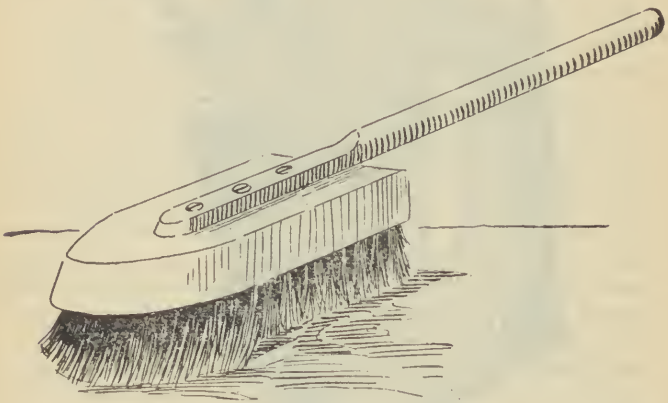

Fig. 23. Scrubbing brush for latrine seats, toilet bowls and urinals. Made by fastening a handle onto one-half of scrubbing brush.

c. The seat covers must be kept closed when not in use and the box must be kept fly tight. Fly traps should be placed in or near each latrine; these are to be maintained in good working condition.

d. An ample supply of toilet paper should be readily available.

e. The latrine should be enclosed by a canvas screen; if this is not available, a brush screen may be used.

f. A drainage ditch 6 inches deep should be dug outside the latrine enclosure in such a way as to carry surface water away from the pit.

g. Deep pit latrines should be closed when filled to within 2 feet of the surface. The box should be removed, the pit contents sprayed with crude oil, covered wtih burlap, and the pit filled with dirt domed 12 inches above the surface. The site should be placarded with the date of closure and name of the organization, if military conditions permit.

Pail latrine. By placing hinged doors on the rear of, and, a floor in the standard latrine box, it may be used for a pail latrine (Fig. 24). The pail is placed directly below the seat and if located in building, the hinged doors should open directly to the outside. The latrine seats and rear doors should be self closing and the box made as nearly fly proof as possible. The floor should be waterproof, concrete if possible, and have sufficient slope to promote rapid and thorough drainage of the wash water. A trough urinal may be installed within the latrine building with a drain pipe leading into a container outside the building. The pails must be removed and emptied daily, being replaced by clean pails, the bottom of which should contain about one inch of a

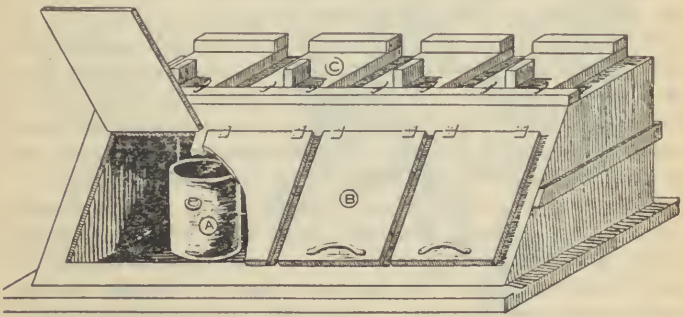

Fig. 24. Method of adapting standard latrine box for use as pail latrine. A-Latrine pail. B-Hinged doors. C-Self closing lids.

2% solution of cresol. The latrine box must be cared for as described under deep pit latrines. The disposal of the excreta from pail latrines may be accomplished by burial or incineration. It may be possible at times to empty the pails into a manhole of a nearby sewer.

SMALL SEWAGE DISPOSAL SYSTEMS

The sewage from groups of buildings having a piped water supply but no connection with a sewer system may be disposed of, either prior or subsequent to some form of treatment, by discharge into a nearby stream, or on the surface of the ground at some isolated spot. Usually, the sewage must be treated prior to ultimate disposal. A typical treatment installation consists of a grease trap, a small septic tank with a siphon and siphon chamber, distributing box, and a tile field in which the effluent is disposed of by sub-surface irrigation.

The small septic tank. The most common method and, if the effluent can be safely disposed of, the most satisfactory method of treating sewage where a sewer system is not accessible, is by means of a small septic tank. The capacity of the tank should be not less than 30 gallons per person. In order to compensate for the uneven flow through small tanks, the tank usually has a capacity equal to about a 24-hour flow of sewage, and therefore a detention period of 24 hours. A 500 gallon tank should be installed for 10 persons and a 2500 gallon tank for 50 persons. The minimum size for any one tank should be not less than 50 cubic feet (375 gallons).

Construction of the tank. (Fig. 25). The tank is usually rectangular in shape, although cylindrical tanks are sometimes used. The depth should be no less than 36 inches below the flow line, with not less than 12 inches of free board above the flow line. The width, in rectangular tanks, should be approximately one-half of the length. The inlet and outlet pipes are on a level with the flow line and usually

curve downward and terminate at about mid-depth of the tank. Instead of curving downward they may be guarded by scum boards placed a few inches in front of the inlet and behind the outlet. The tank may have one or more hanging baffles which extend about 18 inches below the surface. The baffles may also serve as scum boards by extending 6 or 8 inches above the flow line.

The tank is usually made of concrete, with the walls about 6 to 10 inches in thickness. It is usually covered and provided with a capped vent pipe and, in the larger tanks,

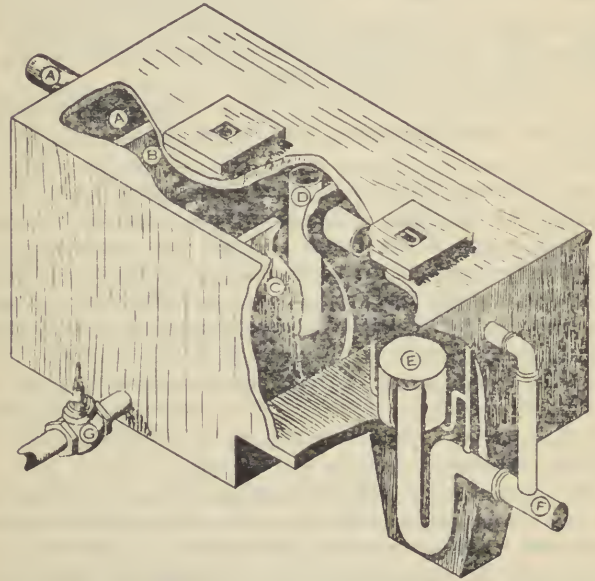

Fig. 25. Small septic tank (Schematic). A-Inlet. B-Baffle. C-Siphon chamber. D-T-shaped outlet, tank to siphon chamber. E-Siphon. F-Effluent line. G-Valve on sludge line.

with an 18-inch manhole. The cover may be made of plank or concrete.

A clean-out drain should be provided. This drain usually consists of a 4-inch cast iron pipe and passes through the wall of the tank near the bottom. It is equipped with a gate valve just outside the tank. The valve stem passes up to a brick, concrete, or tile valve box at the surface of the ground. The drain may be connected with a 6-inch tile pipe through which the sludge flows to the place of disposal.

Location of the tank. The tank is, as a rule, placed underground with the top level with or slightly below the surface of the ground. It must be accessible for inspection and cleaning. If possible, the tank should be so placed that sufficient fall can be secured for drainage of the sludge by gravity through the cleanout drain.

The tank should be placed as far away from an inhabited building as practicable, and never within 100 feet of a spring or well.

Sewer from buildings to tank. The drain pipe of the buildings and the inlet of the tank are connected by means of a house sewer of 4 or 6-inch vitrified clay sewer pipe with bell and spigot ends. The house sewer should, if practicable, be laid in a straight line from the house to the tank. A manhole should be intalled if it is necessary to make a bend of as much as 45 degrees. The grade of a 4-inch sewer should be at least 20 inches per 100 feet, and for a 6-inch sewer not less than 10 inches per 100 feet. The joints should be made tight with cement mortar and the roots of trees and shrubs should be avoided.

The grease trap. Grease and soap from kitchens and baths will interfere with the operation of a septic tank and purification field installation and should be removed from the sewage with a grease trap. The kitchen and bath wastes are drained through a grease trap and a separate waste pipe

into the house sewer beyond the connection of the sewer with the drain pipe so that no wastes from toilets will pass through the grease trap.

Disposal of the effluent. The tank effluent is usually disposed of in tile fields by sub-surface irrigation, in the case of the smaller installations.

Tile fields. (Fig. 26). A tile field consists of lines of open joint tile. The tile are usually laid from 12 to 20 inches below the surface of the ground. There may be a single line of tile or a main line with a number of lateral lines. Two or more separate tile fields may be employed in the case of larger installations.

As a rule, farm tile 4 inches in diameter is used. Larger or smaller sizes may be used depending on the ratio between the amount of sewage received at each dose and the total length of the drains.

The tiles are laid with a fall of from 2 to 6 inches in 100 feet, and with the ends of the sections separated by about ¼ inch. The trenches are 1 foot in width and the tiles are placed on top of a layer of gravel, cinders, or other porous material from 6 to 12 inches thick. The material need not be placed around or above the tile, but a piece of tar paper or burlap, or a half collar of pipe should be laid over the top and sides of the opening between the ends of tiles to exclude earth. The trench is backfilled with earth. If more than one tile line is constructed, the lines should be not less than 6 feet apart.

The length of tile line required for any installation is governed by the ability of the ground to absorb fluids, as determined by the character of the soil and the amount of rainfall. About 20 feet in loose sand and gravel, from 25 to 50 feet in loam, or in loam and sand, and about 100 feet in clay and gravel or loam soils should be provided as a minimum for each person. This method cannot be used successfully in tight clay soils or hard pan. All tile lines should be

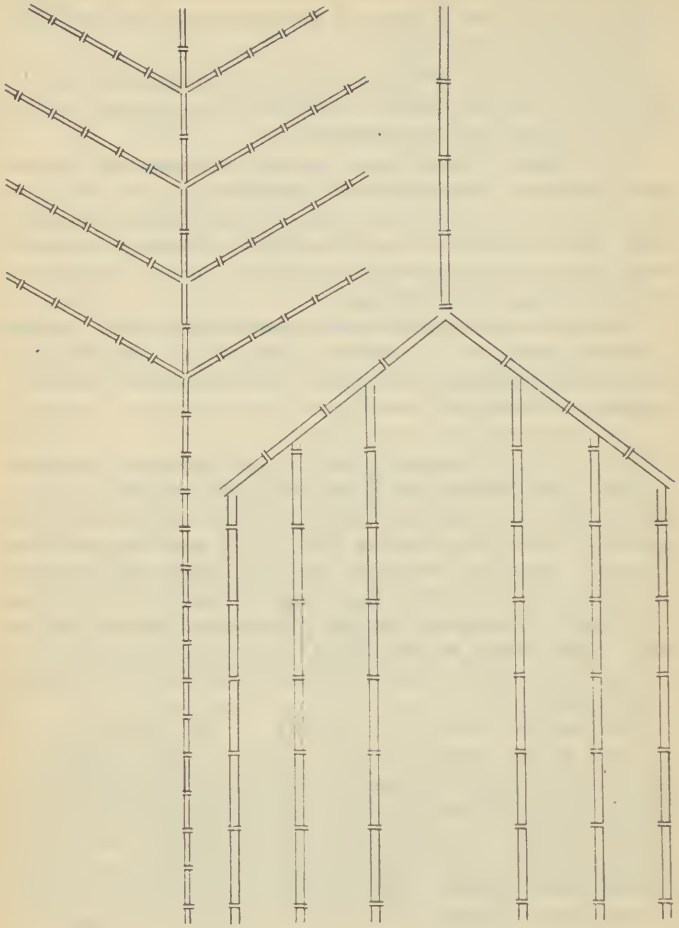

Fig. 26. Subsurface irrigation; layout of tile fields.

so constructed that they can be lengthened if necessary. The tile line or field should be at least 100 feet from the nearest well or spring.

Application of sewage to the tile fields. The tank is connected with the tile field or distribution box by a 4-inch sewer of bell and spigot pipe with tight joints. The fall should be at least 5 inches per 100 feet. If a siphon is used, the fall between the tank and the tile field should be at least 2.5 feet.

Siphon and siphon chamber. All tanks, particularly those of more than 500 gallons capacity, should be equipped with siphon chambers. The effluent from the smaller tanks may be allowed to overflow directly into the sewer leading to the tile field. However, when this is done, the liquid tends to pass out of the tiles in the upper part of the line and, if there is any considerable amount to be disposed of, the soil in the vicinity of the first few tiles will soon become clogged or water logged.

When the tile field is dosed by means of a siphon, a sufficient quantity of the effluent is discharged at one time to insure that all of the tile lines receive sewage throughout their entire length. In the interval between discharges the sewage seeps out of the tiles and is absorbed into the soil. Usually, the capacity of the siphon chamber is about one-fifth of that of the septic tank, and should not be more than 75 per cent of the capacity of the tiles that are to receive the dose.

Distribution box. The distribution box is a small tank set in the sewer leading from the tank to the tile field and serves to equalize the flow of sewage to the different tile lines. The outlet sewer of the tank carries the sewage into the distribution box and there is an outlet from the box for each tile line. If there is more than one tile field, each field has a secondary distribution box which receives sewage from an outlet in a main distribution box. The distribution box is

usually about 20 inches deep and 1 foot wide. The length is governed by the number of outlets. The outlets pipes should be on the same level at or near the bottom of the box. The sewer should enter not more than 2 inches above the bottom of the box. The distribution box can also be used as a diversion chamber by controlling the flow of liquid into the outlets by means of stop-boards which fit against the ends of the outlet pipes. By adjusting the stop-boards, one tile field, or a part of a field, can be utilized while the other fields or lines are resting.

The drains from the distribution box to the tile lines consist of 4-inch bell and spigot pipe laid with cemented joints.

Care and operation. No rags, rubbish, or sticks should be allowed to enter the disposal system, as such material is not disintegrated in the tank and frequently causes stoppage in the pipes or tiles.

The tank should be cleaned whenever the sludge occupies as much as 25 per cent of the depth of the tank. If the tank has a clean-out drain, the sludge is allowed to flow through the drain pipe to a shallow pit which is then covered with boards and earth. In the absence of a clean-out drain the sludge and the overlying fluid must be dipped or pumped out and hauled or carried away to the pit. Normally, the tank will require cleaning at intervals of from 6 months to several years.

The tank should be inspected at monthly intervals and the depth of sludge ascertained. If the scum becomes thick enough to reach the top of the septic tank or the cover, or to interfere with the escape of gases, it may be broken up with a pole so that some of it will sink to the bottom.

The grease trap should be inspected and the grease and debris cleaned out at intervals of not more than a month.

Should the soil around any tile line show evidence of over-dosage, as indicated by odors, water soaked earth, or pooling of the fluid on the surface, the flow to that line

should be shut off at the distribution box by a stop-board or plug and the soil permitted to rest until it is again in good condition.

Bath water may be disposed of in the manner described below for the disposal of liquid kitchen waste.

KITCHEN WASTES.

Kitchen Wastes. These are the food remants accumulated after meals and in the preparation thereof, and the water in which kitchen utensils and mess gear have been washed. The amount of kitchen wastes varies considerably, especially the liquid. However, solids average about ½ pound per person per day and liquids in the amounts of 200 to 1000 gallons are generally obtained from a company of 200 men. These wastes must be so disposed of as to prevent their giving rise to offensive odors and attracting flies and rats to the mess area. Solid kitchen wastes may be disposed of relatively easily but the disposal of liquids becomes increasingly difficult as larger quantities of water are used. For camps of short duration, one night to a few days, both liquids and solids may be disposed of by burial.

Garbage is often disposed of by contract, to be used as food for hogs and it may be used on military reservations for this purpose. Its disposal by contract to civilians may lead to insanitary conditions about a camp through spillage in transfer from garbage cans to other containers, leakage of containers, failure of collection, or unsatisfactory cleaning of cans. When thorough cooperation with the contractor can be maintained so as to insure cleanliness in the procedure, there is no objection to this method of disposal. However, the site of final disposition, the place where the garbage is fed to hogs, should be far enough removed from the camp that odors and flies will not become a nuisance

When garbage is to be used as food for swine, it is necessary to separate it into edible and non-edible portions and the latter should be disposed of by incineration. It is neces-

sary also to take considerable care that substances harmful to hogs do not get into the edible portions. Lye and bits of broken glass are especially injurious to hogs.

Except when it is disposed of by burial, it is desirable that garbage be separated into liquid and solid portions by passing it through a drainer such as is shown in Fig. 27.

Liquid Waste. Liquid kitchen waste in amounts not in excess of 200 gallons per day are best disposed of through *soakage pits.* (Fig. 28). A soakage pit is constructed by digging a hole 4 feet deep and 4 feet square and filling with

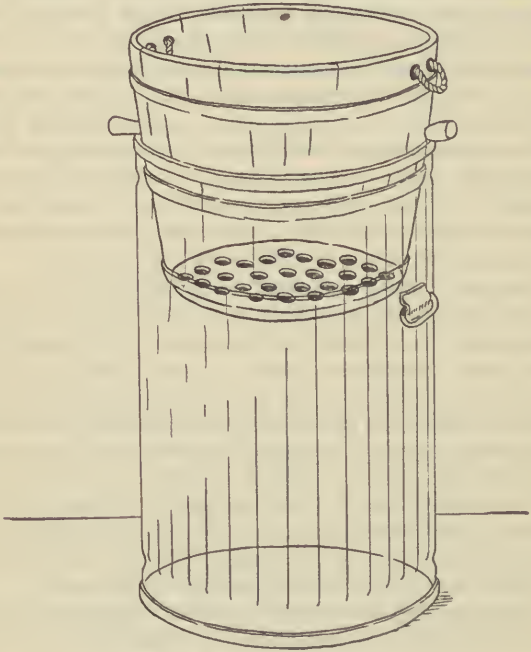

Fig. 27. Garbage drainer.

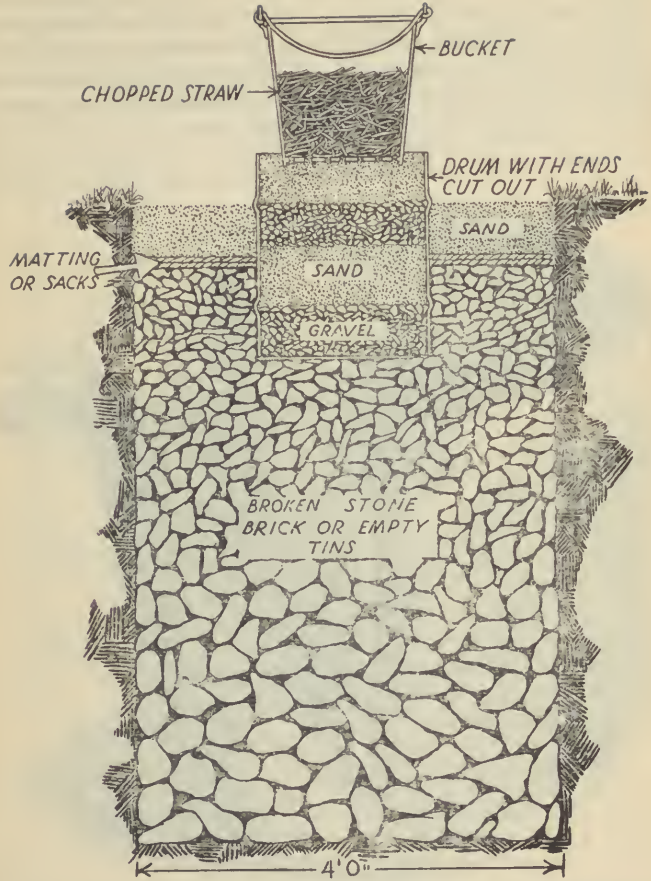

Fig. 28. Kitchen soakage pit.

broken rock, larger size (3 inch) toward the bottom, and smaller size (1 inch) toward the top. The water before being placed in the soakage pit must be passed through a grease trap, (Figs. 29, 30 and 31) to remove food particles and as much grease as possible; otherwise, the side walls of the pit soon become coated with grease and debris and the leaching of water into the soil is prevented.

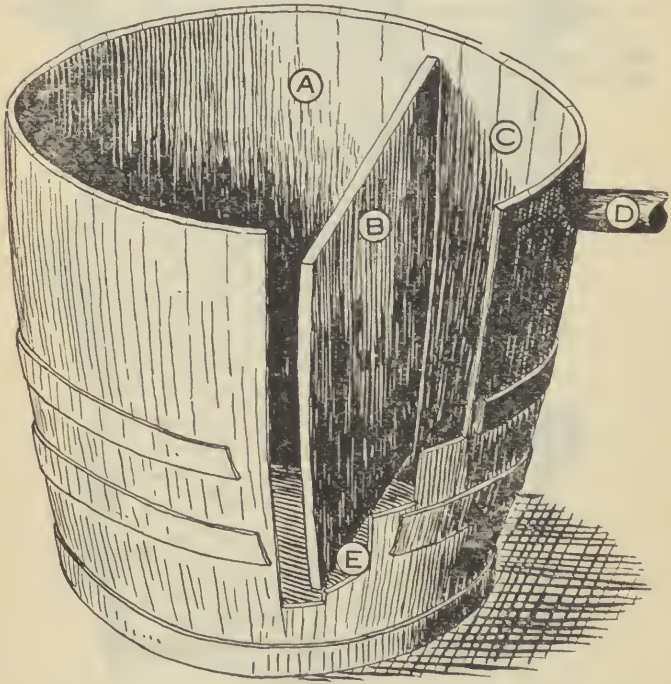

Fig. 29. Cool water grease trap. A-Influent chamber.C-effluent chamber. B-Baffle. E-Passage under baffle. D-Effluent line.

The *cool water grease trap*, Fig. 29, is made of a half barrel divided into two unequal chambers by a wooden baffle extending to within one inch of the bottom, the larger chamber, two-thirds of the barrel, being the influent and the smaller the effluent chamber. The trap is provided with a hinged removable lid and inserted into the lid of the influent chamber is a metal strainer 8 inches square and 6 inches deep, the bottom of which contains many perforations and which is filled with straw to prevent the coarser solids from

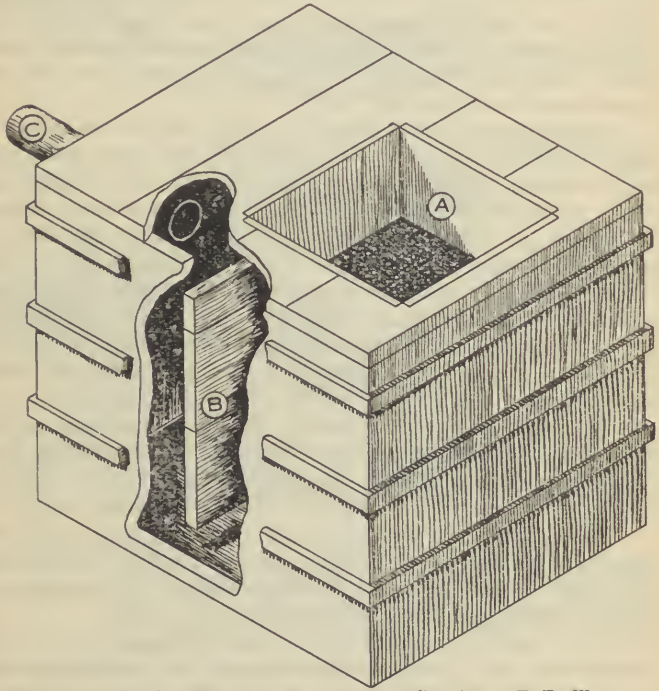

Fig. 30. Cool water grease trap. A-Strainer. B-Baffle. C-Outlet.

entering the trap. The strainer is made removable to facilitate cleaning. A one-inch pipe is inserted in the upper third of the effluent chamber leading to a V-shaped trough which carries the effluent to the soakage pit. In operating the trap, both chambers are filled with cool water. When warm greasy water is poured into the trap, the grease rises to the surface on the influent side and is prevented by the baffle board from reaching the outlet to the soakage pit. Meticulous attention is necessary in order to prevent such a trap from becoming a nuisance. The trap should be drained daily, the sediment removed and burned and the trap, including the removable strainer, thoroughly cleaned with soap and water. Instead of using a barrel, the trap may be built as a rectangular box. Fig. 30.

An *ash barrel grease trap* Fig. 31 is prepared as follows. Using a barrel of about 50-gallon capacity and with one head removed, bore thirty 1-inch holes in the remaining head. Place about 8 inches of gravel or stone in the bottom, the size of the stone decreasing from one inch at the bottom to ¼-inch at the top, and over this place 16 inches of wood ashes. Fasten a piece of burlap over the open top of the barrel by means of a hoop. The trap may be placed directly on the soakage pit or on an impervious platform which drains into the pit. The sullage water is poured into the barrel through the burlap, food particles thus being strained out. As the greasy, soapy water filters through the ashes the greater part of the grease and soap will be removed. The burlap should be removed daily and burned and it will be necessary to replace the ashes every three or four days.

When more than 200 gallons of water per day are to be disposed of, additional soakage pits and grease traps are necessary. When the quantity is in excess of 500 gallons per day, a different procedure is advisable.

Up to 10,000 gallons of water may be disposed of by the construction of a combined grease trap and settling basin, the size of which will be determined by the volume of water

Fig. 31. Grease trap. 1. Made by boring a number of one inch holes in the bottom of a barrel, filling the lower 8 inches of the barrel with gravel or small broken stones and placing above that 12 to 18 inches of wood ashes. A piece of burlap fastened over the top of the barrel with a hoop serves as a strainer.

used. (Fig. 32). For handling 10,000 gallons of water the tank should be 25 feet long, 8 feet wide and 5 feet deep, divided into two unequal portions by a wall located 5 feet from the inlet end. In the smaller compartment, 5 x 8 x 10 feet, there should be a baffle wall 3 feet from the inlet and extending to within 6 inches of the bottom. The smaller compartment forms a grease trap while the larger compartment acts as a settling basin and when built of this size, 5 x 8 x 20 feet, will hold nearly 5000 gallons of water, so that there will be a retention period in the tank of about 12 hours. The inlet and outlet lines should be 4 inches in diameter and located in the end walls one foot below the top of the tank. The outlet from the grease trap proper to the settling tank should be of the same diameter and similarly located. The inlet and outlet should be submerged.

That portion of the tank which forms the grease trap consists of two compartments separated by the baffle and water entering the trap, passes under the baffle into the large compartment, the grease floating to the surface in the first compartment whence it is skimmed off daily and burned.

In the larger portion of the tank, 5 x 8 x 20, the detention period is sufficient to bring about a fairly complete settling of all suspended matter and the water leaving it may be disposed of in a stream satisfactorily, provided the flow of the stream is at least 500,000 gallons per day. If the stream available is small so that emptying this water into it will lead to a nuisance or if there is no stream at all the water may be disposed of by sub-surface irrigation as described on page 49.

If the ground is impervious, water can escape only into the top soil where it will be disposed of chiefly by evaporation and sub-surface disposal cannot be used. In such a case a system of shallow open trenches similar in layout to that described for sub-surface irrigation may be used. These trenches should be 6 inches deep and 12 inches wide.

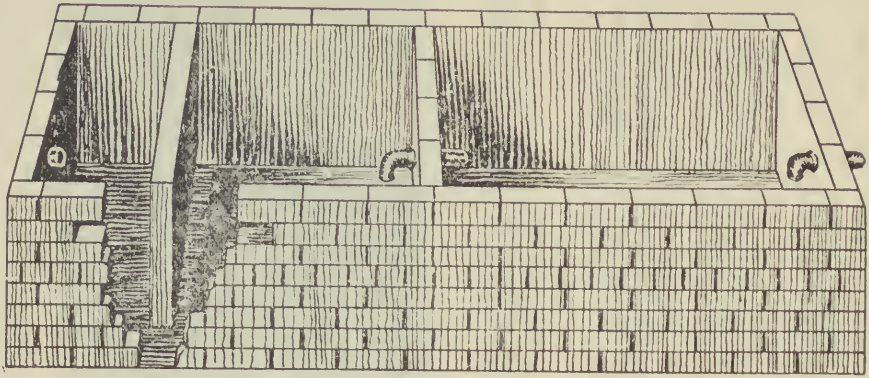

Fig. 32. Settling basin, schematic.

Solids. In temporary camps, construct a *cross trench incinerator* by digging two 8 foot trenches, 10 inches wide, 10 inches deep,—crossing at their centers. Place pieces of scrap iron across the trenches where they intersect to act as a grate and as a support for an old galvanized iron can, the bottom of which has been removed. (Fig. 33). Such an incinerator is satisfactory for camps of a month or less. For longer periods, build an incinerator on the same principle but use stone instead of the galvanized can and cover the outside with puddled mud or clay. A still better incinerator can be built by setting a barrel, both ends of which have been removed, over the intersection of the trenches and covering the barrel with a layer of clay which has been wet sufficiently

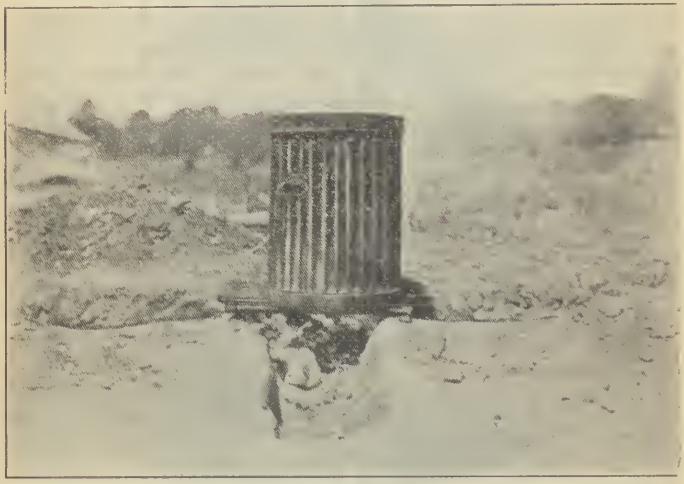

Fig. 33. Cross trench incinerator with stack made from galvanized iron garbage can the bottom of which has been removed.

to mold well. (Figs. 34 and 35). Cross trench incinerators work better when three of the trenches are closed off, leaving one open toward the direction from which the wind is blowing. Properly fitted pieces of tin may be used to close the trenches. The incinerator should be stoked from the top only, rubbish, cans, and wood being mixed with the drained garbage.

An *inclined plane incinerator* such as is shown in Figs. 36 and 37 will probably be more satisfactory than a cross trench incinerator in semi-permanent camps. In such an incinerator, the garbage is fed into the upper end of an incline and is gradually pushed down to the lower end, drying and burning as it progresses, final combustion taking place on a grate at the lower end. The incline is closed over so as to retain the heat and direct it onto the mass of drying garbage. In the incinerator shown, the incline is made of corrugated iron resting upon a rock bed and the incline is covered over

Fig. 34. Cross trench incinerator made by molding clay around a barrel set across the trench intersection.

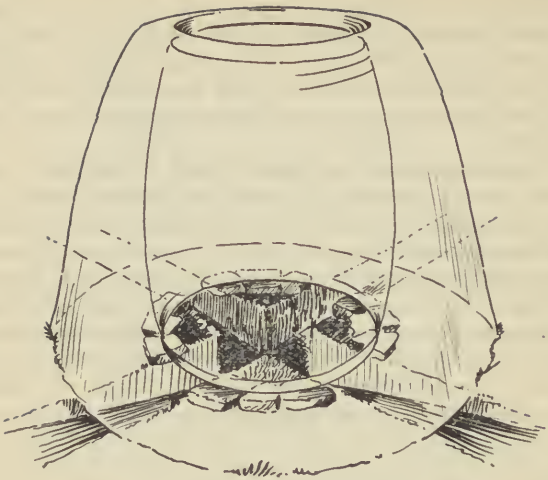

Fig. 35. Cross trench incinerator showing method of construction.

with portions of steel oil drums. There is a loading and stoking area at the rear and a grate area at the front. The stoking area is closed over with a hinged iron cover, a vent 5 x 16 inches for draft being left at the outlet of the incline and the grate is covered with a door which may be opened as desired for draft.

The walls of the incinerator may be laid up with stone, brick, or concrete. Sections of two oil drums are used to form the cover, the drums being cut longitudinally four inches above the center and the smaller sections used, the ends being left in place. These sections are placed end to end, supported on the sidewalls eight inches above the inclined floor. Puddled clay to a depth of two inches is placed over the top of the drums.

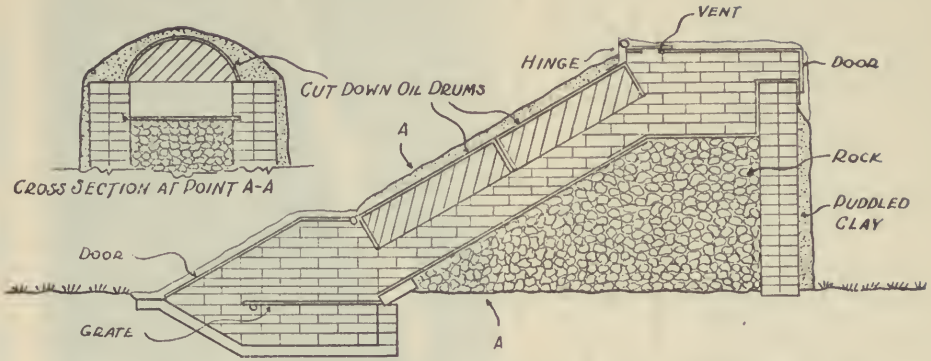

Fig. 36. Inclined plane incinerator, in longitudinal and cross sections, to indicate plan of construction.

In use, a fire of wood and rubbish is built on the grate and after the incinerator has become hot a canful of drained garbage is emptied onto the stoking area, some being pushed part way down the incline. As the garbage dries on the incline it is pushed farther down until it burns, being replaced by other garbage from the stoking area. The cover over the stoking area serves to retain heat, so that considerable drying and even burning takes place. The ends of the sections of oil drums serve as baffles which give rise to swirling of the burning gasses and apparently aid greatly in the drying and combustion.

ANIMAL WASTES.

Animal Waste (Manure). Consideration of the disposal of horse manure is important to troops in the field as it affords a breeding place for flies. The amount of manure

Fig. 37. Inclined plane incinerator.

to be disposed of averages 10 pounds per animal per day if animals are on a picket line and 25 pounds if the animals are kept in stables. Manure from a picket line of a week's duration may be scattered and dried by sunlight. If the camp lasts more than one week other means of disposal must be made. They are: disposal by contract or by composting. If by contract, care must be taken to see that the manure is collected and transported so that fly breeding within the camp is prevented and that it is finally disposed of far enough away that flies will not return to the camp. Disposal by composting is recommended and is considered later in this section (see fly control, page 70.

Manure which has been properly composted and is 1½ to 2 years old should be used for fertilizer and such manure will not serve as a breeding place for flies.

RUBBISH.

Rubbish. Accumulations of rubbish attracts flies and rats which in turn act as the transmitting agents of certain diseases to which men are susceptible. All rubbish, not garbage, should be collected in gunny sacks at both ends of the company street and in latrines each day. It should then be transferred to company incinerators and burned. In semi-permanent camps it may be disposed of on a dump, being burned there daily.

FLY CONTROL

Development and Characteristics. A brief description of the development of the house fly and some of its characteristics are essential to the understanding of the control procedures recommended. In its development the fly passes through four stages—the egg, the larva, the pupa, and the adult. (Fig. 38). The eggs are oval, white, glistening bodies about 1/20-inch in length. They are deposited by the adult female in masses of 150-200 in warm moist organic materials

preferably horse manure. The egg stage lasts about 12 hours, varying considerably with the temperature. The larvae (maggots) are cylindrical, whitish, segmented, worm-like creatures about 1/3-inch in length. They are very motile and feed upon the surrounding organic material and reach maturity in two to eight days. When mature the larvae migrate to a dry cool place and pupate. The larvae are quickly killed by a temperature of 115°F. The pupa is dark brown in color, has a hardened outer surface and is about ¼-inch in length. The stage lasts 2-8 days. The adult fly emerges from the pupal case and is ready to fly as soon as its wings harden. The female reaches sexual maturity and begins to deposit eggs in 3 to 20 days after emerging from the pupal case. Under favorable conditions, the period from the egg to adult may be as short as one week. Thus material in which the immature forms develop may produce flies if neglected for longer than one week.

The characteristics of the fly which are important in its control, include:

a. Their breeding places of choice, which are horse manure, human excreta, and fermenting vegetable wastes.

b. The necessity of moisture, warmth and soluble food for the development of the larvae.

c. The fact that temperatures of 115°F. or above will kill the eggs and larvae.

d. The tendency of the larvae to migrate from the breeding material prior to pupation.

e. The ability of the larva and adult to crawl through loose manure or earth.

f. The attraction of adult flies to food by odor.

g. Their tendency to go toward light.

h. Their tendency to rest on vertical surfaces and hanging objects.

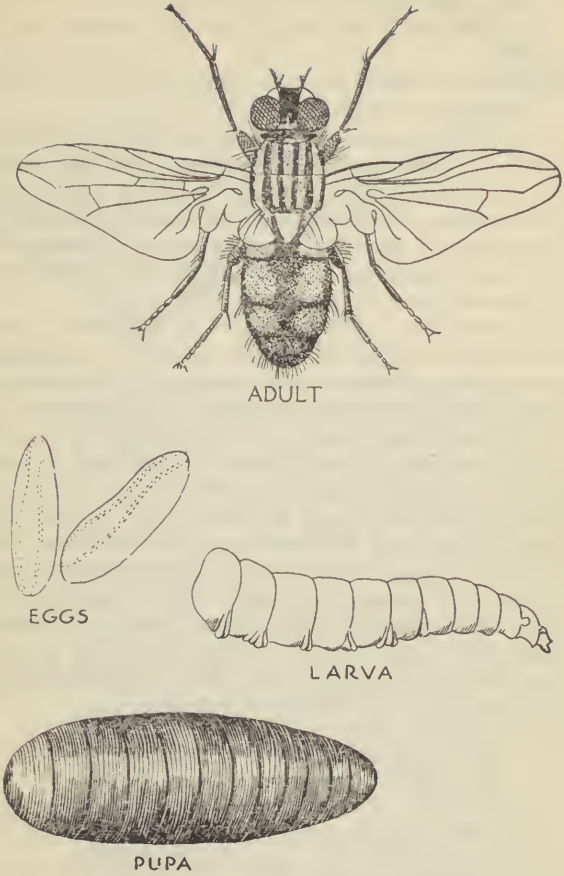

Fig. 38. Housefly, stages in development.

i. The optimum for breeding is 80-95°F.
j. The range of flight is 200-1000 yards.
k. The number is greatest in the late summer and early fall.
l. Continuous breeding may occur during the winter in heated buildings.

Control. The control of flies depends upon a knowledge of the characteristics enumerated above and the necessary measures to render the customary breeding places unfavorable for breeding, to kill the larvae by use of larvicides, to kill the adult flies, to dispose of human excreta in such a manner, previously discussed, that it will be inaccessible to flies, and to protect food from flies.

The control of breeding places is essentially the problem of the proper disposal of horse manure. Its disposal in temporary camps is considered above and its disposal in semi-permanent camps may be accomplished by *composting*, which is the close packing of manure on a platform. In properly composted manure, a temperature of 140-160°F. is reached at a depth of one foot below the surface; such a temperature will quickly kill the fly egg and larva. By the use of larvicides the fly larvae on the surface can be destroyed. Fig. 39 illustrates the proper construction of a compost platform and gives detailed instructions for operating a compost pile.

The compost pile should be located over 1000 yards from the camp and where it will not be an unsightly nuisance.

The following larvicides are effective in destroying fly larvae, they are listed in order of efficiency:

a. Cresol ..... 2 parts.
   Kerosene ..... 20 parts.
   Fuel Oil ..... 78 parts.

b. Cresol ..... 2 parts.
   Soap Suds ..... 98 parts.

c. Waste Motor Oil.

d. Crude Oil.

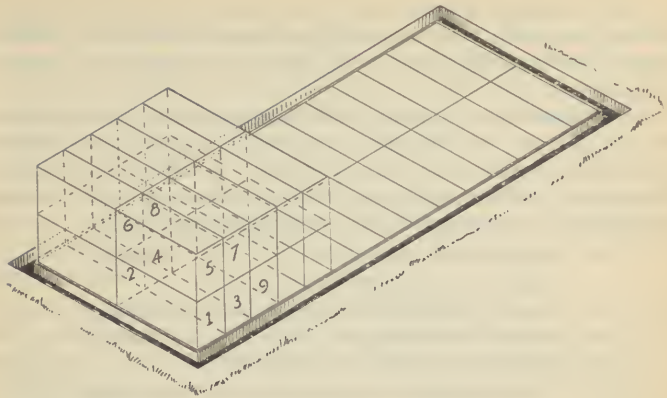

Fig. 39. Compost platform. This platform is constructed by leveling off an area of ground, 50 feet long, and 20 feet wide, digging a trench around the area 12 inches wide and 12 inches deep with vertical sides. Constructing a second trench, very shallow, not over 3 inches deep and 4 inches wide, and located just within the edge of the platform. The manure is placed on the platform as follows: Beginning at one corner, place the manure on an area 3½ ft. long and 10 ft. wide, piling it to a height of 4 to 5 feet, packing it down very tightly and dressing the sides neatly. The sides must at all times be kept vertical. The second day's supply of manure is placed on the adjacent corner in a similar manner. On the third day, the supply of manure is placed immediately adjacent to the first pile and on the fourth day, adjacent to the second pile, and on the fifth day the supply is piled on top of the first pile. The manure is thus placed on the platform in the succeeding small sections as shown in the diagram. This is done for the purpose of confining the fly breeding to the smallest possible area. The manure should be kept moist so as to promote decomposition. The sides of the pile should be sprayed daily with a mixture of cresol, kerosene and fuel oil. Crude oil or a light road oil is used in the trenches, the earth in the trench being kept visibly moist with oil. In the preparation of the platform, all vegetation should be removed for a distance of 2 feet from the edges, the earth here tamped down firmly and oiled thoroughly; similarly, the earth beyond the trenches should be freed from vegetation, packed down and oiled. The trenches are to be kept clean at all times. A platform this size should care for the manure of 100 animals for two months.

Larvicides should be applied by means of a spray, an excellent one being the knapsack spray seen in Fig. 51. (Disinfector, hand spray, item 77900, Medical Department Supply Catalogue).

The destruction of adult flies is accomplished by swatting, use of poisons, sprays, fly wire and fly paper, and by fly traps. Swatting to be effective must be carried out continuously. Formaldehyde and sodium salicylate are efficient fly poisons. The formulas for preparing them are:

a. Commercial Formalin ..... 2 parts.
   Milk or sweetened water or milk
   and 50% lime water ..... 98 parts.
b. Sodium salicylate ..... 1 part.
   Sweetened water (1 teaspoonful
   brown sugar to 1 pint water) ..100 parts.

A satisfactory method of using poisons is to fill a drinking glass 2/3 full of the solution, place over the top of the tumbler a circular piece of blotting paper, the diameter of which is two inches more than the diameter of the tumbler, and cover with an inverted saucer. The whole apparatus is then inverted and a match is inserted under the edge of the glass. The liquids seep out keeping the blotting paper moist.

Fly sprays are useful in mess halls; the formulas for two such sprays are:

a. Oil citronella ..... 5 parts.
   Kerosene ..... 95 parts.
b. Crude pyrethrum powder ..... 1 pound
   Kerosene ..... 1 gallon.

Soak the pyrethrum in the kerosene for 2-4 days and pour off the supernatant fluid for use.

Sprays are applied by means of small hand sprays and are most effective when applied to groups of flies resting on ceilings or walls.

Fly wire or *fly paper* hung vertically from ceilings or rafters aid in eradicating flies from buildings. The mucilage

on the wire or paper is prepared by heating (without boiling) together one part by weight of castor oil and two parts white rosin. The wire used consists of ordinary bailing wire, several 18 to 36 inch pieces being twisted together and coated with the mucilage by dipping the wire into the mucilage container. The fly paper consists essentially of narrow strips of paper, wrapping or glazed, 18 to 36 inches in length, each side of which is coated with fly mucilage. When they have become covered with flies the wires are wiped with a cloth to remove the flies and mucilage and are recoated. The used paper is burned.

Fly traps will catch many flies if properly cared for and any well constructed trap is satisfactory. They consist of two main parts—the bait chamber and the trap chamber. The former is the lower and darker part into which the flies are attracted by the odor of the bait. The upper and lighter part is the trap chamber and is connected with the bait chamber by a small opening through which the flies crawl toward the light after having fed on the bait. The construction of fly traps is simple and the following discussion and Figs. 40 and 41 indicate the details of their construction.

A square fly trap such as shown in Fig. 40, is made 12 to 18 inches square and 18 to 24 inches high. The corner uprights and connecting lateral strips are made of boards 1 inch thick and 1½ inches wide. The framework is covered with No. 14 mesh wire screening tacked to the corners and connecting strips. The lid is a screen frame which fits down over the top. The bait chamber is inside the trap and is made of screening tacked to the edges of the lower lateral strips and terminating in an apex 10 to 14 inches above the bottom of the trap. At the apex is a ¼-inch hole through which the flies enter the upper chamber. The corner uprights extend 1 inch below the lower edge of the trap to form the supports for the traps.

A box fly trap is made essentially as above except the sides are made of wood. It is constructed as follows: Make

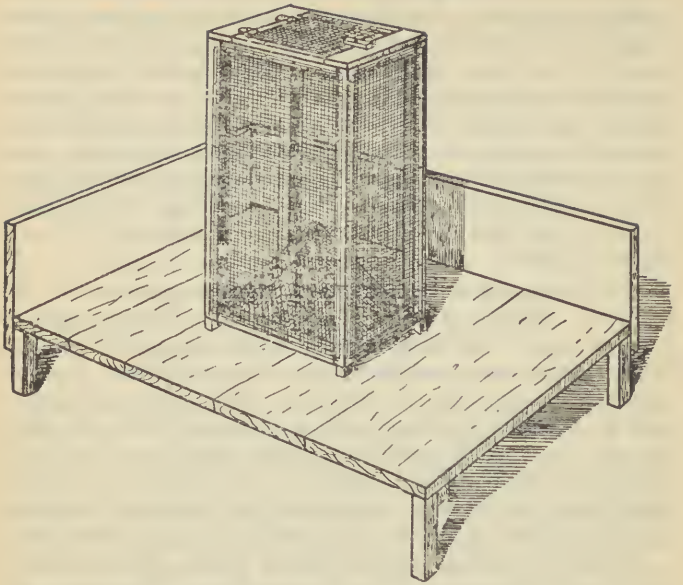

Fig. 40. Fly trap with shield to protect the trap from the wind.

a closely fitting top for an ordinary packing box, 12″ x 18″ x 11″, and cover with screen. Cut a 6″ to 8″ hole in the bottom of the box, over which a wire cone about 10″ high with a ¼″ hole at the top is tacked. The corners are raised from the ground by 1″ blocks.

Fig. 41 illustrates the construction of a fly trap made from an ordinary 3 to 5-gallon metal bucket. The bottom of the bucket is cut out, except for one inch around its outer border, to which a wire cone is soldered. A top is made which fits down into the bucket a distance of one inch and is screened except for one inch of metal about the outer border.

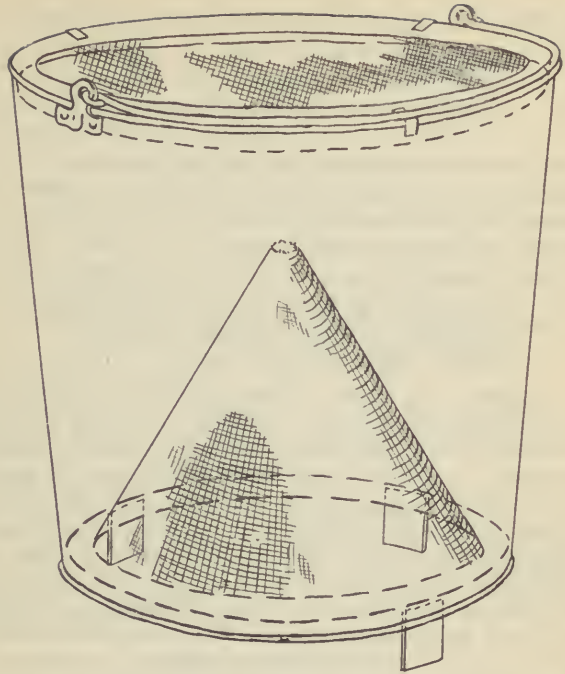

Fig. 41. Fly trap, showing method of construction, using ordinary metal bucket.

The top is held in place by three pieces of copper soldered to the outer side of the bucket so that they may be bent over the cover. The bucket is supported by three pieces of metal one inch high, which are soldered to the bottom of the bucket.

Fly baits. A satisfactory bait must have an odor attractive to flies and in turn not be offensive in appearance or odor to people in the vicinity. Fermenting baits are more

attractive to house flies, putrefying bait more attractive to blow flies. An efficient bait is prepared as follows:

Cornmeal	1 lb.
Molasses	½ pt.
Water	1 pt.
Yeast	¼ oz.

Mix the water and molasses and heat to boiling. Stir the cornmeal into the boiling mixture and allow to cool. When cool add the yeast and allow to stand in a warm place one to two days. It is then ready for use.

Other fermented baits are made as follows:

a. 2 parts of molasses and 1 part of vinegar.
b. Crushed over-ripe bananas in milk.
c. Brown sugar and sour milk.

Location of fly traps. Traps in sufficient number should be located near manure piles, latrines, in vicinity of kitchens, mess halls, dumps, and other buildings or areas where flies congregate. They are more efficient if placed in groups of two or three. Traps should be protected from the wind, and this may be done by utilizing a fly trap stand provided with a windshield as shown in Fig. 40. Also, traps may be placed behind objects such as buildings, boxes, and garbage cans which protect them from the wind. If placed on a stand the trap should be at least 12 inches away from the sides of the stand so as not to exclude the light from any side of the trap.

Care of fly traps. Liquid fly bait should be placed in wide shallow containers and there should be at least two inches between the edges of the bait pan and the edges of the trap. The baits should be inspected daily, the containers kept filled to the desired level, cleaned and refilled whenever a scum forms or sediment accumulates, and should be kept free from dirt and dust. The traps should be emptied whenever a sufficient number of flies accumulate to interfere with the admission of light to the trap chamber. The captured flies may be killed by immersing the trap in soap suds.

IMMUNIZATION

In addition to good sanitary control over water, food, and waste disposal, certain intestinal diseases may be further controlled by active immunization. This is especially true of typhoid and paratyphoid fevers and to a lesser extent of cholera and bacillary dysentery.

Active immunization against typhoid fever is required by Army regulations. The vaccine used is prepared at the Army Medical School, Washington, D.C. The present vaccine contains 2,000 million typhoid bacilli per c.c., it does not contain paratyphoid bacilli.

The anti-typhoid vaccination is administered subcutaneously in three doses at 5-7 day intervals. The first dose consists of one-fourth c.c. of vaccine suspension and the second and third doses of one-half c.c. each.

The immunity produced by anti-typhoid vaccination is not absolute but will, except under unusual circumstances, afford protection for as long as three years.

Cholera vaccines provide protection for about six months.

The dysentery vaccines provide protection but for a short time and their administration, especially in the case of the Shiga bacillus vaccine, is frequently followed by very serious reactions. The use of dysentery vaccines is not considered a practicable military procedure.

MESS SANITATION

The underlying principle of mess sanitation is cleanliness. In temporary camps field ranges or rolling kitchens are provided; in semi-permanent camps screened temporary buildings with ranges, ice boxes, and mess tables may be present. In either case, good sanitation is very essential to prevent the spread of disease, particularly intestinal and respiratory diseases.

The proper inspection and storage of foods has been considered earlier in this section. Also, the proper disposal of

kitchen wastes has been detailed. In addition to these, there are certain other requirements for the proper sanitation of a mess.

a. *Dishwashing* in temporary and semipermanent camps. In temporary camps mess gear is washed in galvanized iron cans placed over a fire trench near the kitchen. The trench is 8 feet long, 12 inches wide, and 12 inches deep. The cans may be supported by strips of metal such as steel rails if any are available. A fire is built in the trench and the water heated to boiling sufficiently early to permit a minimum of fire and smoke to be present when the men are washing their mess equipment. The water, however, must be kept close to boiling temperature while it is being used. Three cans should be provided, two containing hot soapy water, the other hot clear water (Fig. 42). The food particles are scraped off into a can or pit in the ground, then each man washes his mess equipment by passing it through the two soapy waters and the clear water. Sufficient time must be allowed to thoroughly cleanse the kits. They should be air dried. The water from the cans must be removed and the cans thoroughly cleansed after each meal. The food particles are buried or disposed of in an incinerator.

In semi-permanent camps, a different apparatus for washing mess kits may be used. (Fig. 43). It consists essentially of a fire trench with a stack at one end and is built over a soakage pit. The pit is 11 feet long, 4 feet deep, and 2 feet wide and is filled to within one foot of the surface with varying size stone. Along the two sides and one end a wall of stone, brick, or concrete is built extending 2 feet above the ground level, forming a fire box. The water containers are made from 50-gallon oil drums cut along the longitudinal axis, 4 inches above the center line. Drums with bungs should be used and so cut that the bungs will be dependent when placed on the

Fig. 42. Washing mess kits.

fire. Pieces of iron pipe of sufficient length are threaded at one end to fit the bung holes and drilled at the other end to receive an iron rod used to turn them in or out. After the drums are placed on the fire box the space between the drums and walls, between the ends of the drums, and between the rear drum and the stack should be filled with clay. This device will require a relatively small amount of fuel to boil the water. The draft will be such that it will be found desirable to place a damper in the stack. The men can wash their mess equipment without being bothered by flames and smoke. When the washing is completed, the iron pipes are removed and the water escapes into the soakage pit.

b. *Physical examination of mess personnel.* All permanent food handlers are required to be examined physically when first assigned to duty and thereafter at intervals of six months. The medical officer concerned

Fig. 43. Device for washing mess kits.

certifies that the individual is free from any communicable disease and is not a carrier of such diseases. Temporary food handlers, 24 hours or less, though not required to undergo examination should not have any symptoms of a communicable disease. In addition, the cleanliness of mess personnel, including their clothing, should be excellent at all times. Any person on duty in the kitchen or like places who presents symptoms of illness, however mild, should be relieved from such duty.

c. *Care of kitchen utensils.* All kitchen utensils and equipment must be cleansed thoroughly with hot soapy water, rinsed with hot clear water and air dried.

d. Mess tables. Where tables are available, they should be so constructed that the middle leaf or board can

be removed to permit cleaning in the space between the boards and removal of any food particles.

e. *Protection of prepared food* This is of great importance as certain foods left over from one meal may again be served in the same or another form. In all such cases, except pastry or uncooked salads, the food should be thoroughly recooked before serving. Hash is the most notable example and if contaminated since its ingredients were first prepared, sufficient toxin may be produced to cause serious illness. In the case of meat salads, the meat should be cooked or reheated sufficiently to destroy pathogenic bacteria within a short time of the serving.

f. *Toilet and lavatory facilities.* Adequate toilets and facilities for washing hands should be readily available to the mess personnel in all situations.

g. *Flies.* Swatting of flies should be carried out continuously during the fly season. Spray may be used and garbage should be placed in covered cans on elevated platforms and disposal of as described above.

h. *Roaches and Ants.* Sodium fluoride placed in cracks, crevices, and about water pipes twice or three times weekly will, if the kitchen is kept clean, greatly aid in the eradication of roaches. Ants may be destroyed by pouring boiling water or kerosene into their nests. The placing of refrigerator and table legs in cans containing water aids in the elimination of ants.

Proper mess sanitation is maintained only by careful daily inspections and the correction of defects as soon as discovered.

RESUME

To prevent the occurrence of intestinal diseases among troops in the field, the following are essential:

1. Good water.
2. Properly inspected, protected and prepared food.
3. Proper disposal of waste materials.
4. Control of flies.
5. Immunization against typhoid fever.
6. Personal cleanliness.
7. Hospitalization of cases.
8. Good mess sanitation.

SECTION IV.

INSECT-BORNE DISEASES

Insect-borne diseases are those transmitted by blood-sucking insects. The more important to American troops are:

Malaria.
Dengue.
Trench Fever.
Relapsing Fever.
Typhus Fever.
Yellow Fever.
Filariasis.
Rocky Mountain Spotted Fever.
Tularemia.

INSECT CONTROL

THE MOSQUITO

Mosquitoes are of importance to the health of man either as transmitting agents of disease producing parasites, or as pests which are sources of discomfort. Mosquito control measures are therefore employed to prevent the transmission or reduce the incidence of mosquito-borne diseases, or to prevent discomfort due to bites of the insects.

PHYSICAL CHARACTERISTICS

In some instances mosquitoes may be difficult to recognize but one can be fairly sure that an insect is a mosquito if it has a long slender body divided into three parts—the head, thorax, and abdomen—two thin transparent wings with

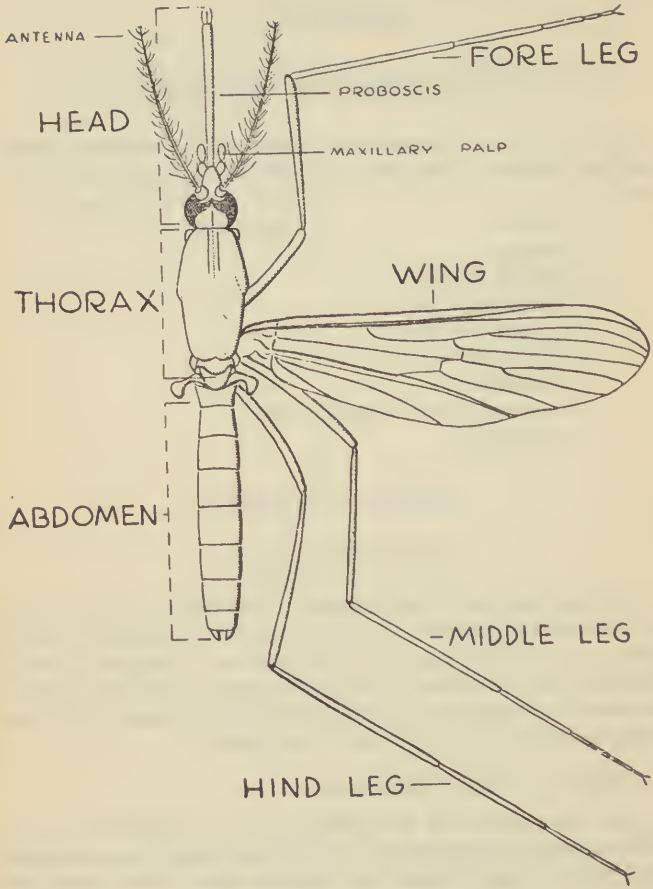

Fig. 44. Mosquito, gross anatomy.

fringe on the rear edge, six long slender legs, two antennae or "feelers", a proboscis which is about the length of the head and thorax and two palpi (mouth parts). Figs. 44, 45, and 46.

LIFE CYCLE

Mosquitoes develop by complete metamorphosis, the life cycle consists of eggs, larval, pupal, and adult stages. The egg, larval and pupal stages are passed in water while the adult is a free flying insect. Males are vegetarians, females are blood suckers and thus act as transmitters of disease. The time for development of the egg is 3 days, the larva, 10 days, the pupa, 3 days. The adult lives for one to three months.

Culex, Anopheles. and Aedes mosquitoes are concerned in the transmission of diseases. It is to their eradication that we devote most of our attention. Their egg, larval, and adult stages are easily identified.

IMPORTANT DISTINGUISHING CHARACTERISTICS

CULEX: Eggs—Cemented in rafts. Lie on the surface of water.

Larvae—Hang at an angle in the water.
Feed below the surface of the water.
Breathe at the surface through a long, slender breathing tube attached to the rear of the body.

Adult—In the resting position the body is parallel to the surface.
Wings have no spots.
Head of the female has short palpi.

ANOPHELES: Eggs—Are boat shaped, laid singly on the surface of water in star or triangular patterns.

Larvae—Lie parallel to the surface of water.
Feed at the surface of water.

Fig. 45. Differences in the antennae of female and male mosquitoes.

Fig. 46. Mosquito wing.

Breathe at the surface, have no breathing tube.
Have a breathing stoma or opening on rear of the body.

Adult—Resting position is at 45 degree angle to the surface.
Wings are spotted.
Head of the male and female has long palpi.

AEDES: Eggs—Lie singly on the surface of the water.
Larvae—Hang at an angle in the water.
They feed below the surface of the water.
Breathe at the surface through a short barrel-shaped tube attached to the rear of the body.

Adult—Their resting position is like the Culex.
Wings have no spots.
Head of the female has short palpi.
See Figs. 47 and 48.

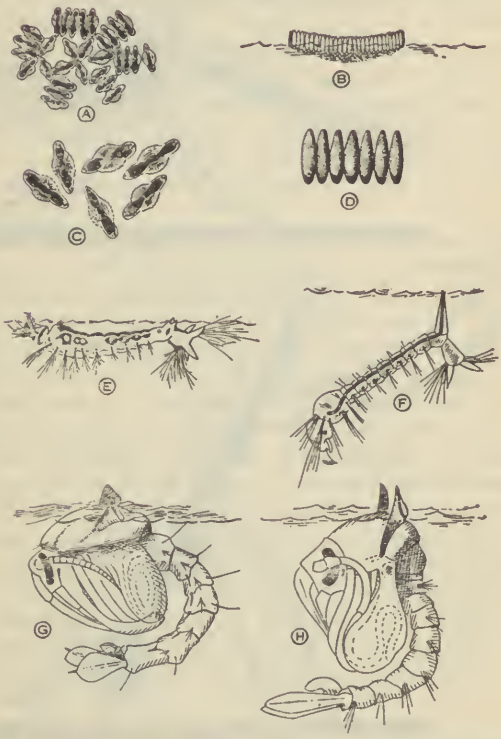

Fig. 47. A-Eggs of Anopheles mosquito. B-Eggs of Culex mosquito (Egg raft). C-Eggs of Anopheles mosquito showing floats. D-Eggs of Culex mosquito. E-Larva of Anopheles mosquito. F-Larva of Culex mosquito. G-Pupa of Anopheles mosquito. H-Pupa of Culex mosquito

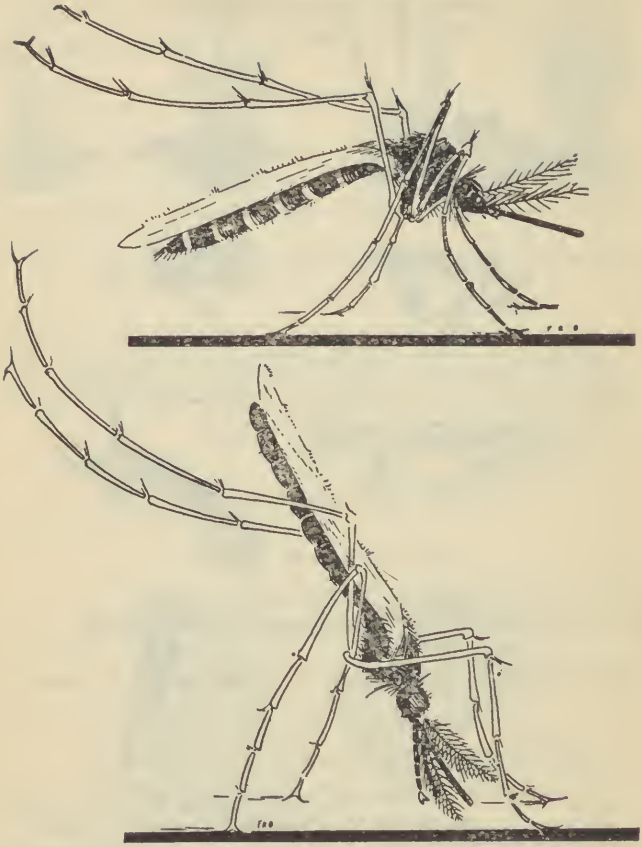

Fig. 48. Mosquitoes, resting position. Upper, Culicini, Lower, Anopheles.

To capture larvae from water one may use an ordinary dipper with a broomstick attached as a handle. Larvae that cannot be identified should be hatched and then identified or packed and mailed according to the following instructions.

The insects caught and killed by the chloroform tube method, should be carefully slid into a pill box, the bottom of which is lined with a layer of glazed cotton. The insects should then be covered with a layer of glazed cotton and the top replaced. Ten to twenty small insects may be put in one box. One or two drops of commercial formalin should be placed on the inside of the lid just before closing the box as a protection from mites. Never allow the insects to become moistened and the greatest care must be used in handling and packing.

After packing the insects, the box is to be plainly labeled with the name of the station, date, hour of collection, and name and rank of the collector, and each shipment will be accompanied by a statement as to the presence of malaria (with type), dengue, filariasis, or other mosquito-borne diseases, the number of cases, and strength of command by race. Collections from all stations will be forwarded by mail to the Curator, Army Medical Museum, Washington, D.C.

A simple hatching device can be made from a lantern globe, the top of which is covered with several thicknesses of gauze, from the center of which a string hangs down for several inches to act as a resting place for adults. Set this globe into a tin receptacle, filled with water, made similarly to a Petri dish or saucer. Cut a one-inch cardboard ring to fit inside the globe to act as a resting place. The larvae placed in this receptacle will hatch to adults in about ten days at which time they can be identified. (Fig. 49).

HABITS:

Practically all mosquitoes breed in comparatively still water, such as slow moving streams, ponds, marshes, swamps, drains, water receptacles, and roof gutters.

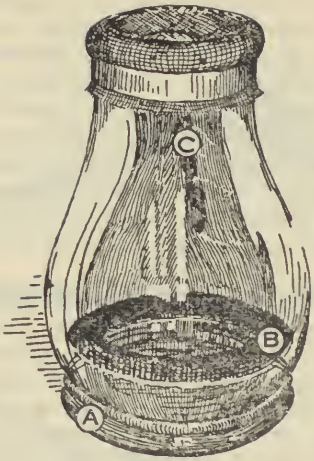

Fig. 49. Container for hatching mosquitoes. A lantern globe resting in a petri dish, the top of the globe covered with gauze. A-Petri dish. B-Cardboard for insects to rest upon. C-Hanging cord to serve as a resting place.

Anopheles—bite at dusk, night and dawn.

Culex—bite at dusk, night and dawn.

Aedes—bite during the day.

Anopheles are classed as wild mosquitoes, so one looks for breeding places away from habitations.

Culex and Aedes are domesticated. Their breeding places are often near and in human habitations.

RELATION TO DISEASE:

Anopheles—transmits malaria.

Aedes—transmits dengue, yellow fever, and filariasis.

All mosquitoes are pests and because of their biting habits interfere with the rest of troops, hence lower morale and efficiency.

CONTROL MEASURES:

1. Eliminate *breeding places.* To be applied only in semi-permanent or permanent camps.

a. *Filling* is cheap and effective. It is the most practical for small storm water areas. One can use earth, rocks, garbage, cinders, ashes, rubbish, and old manure as a fill.

b. *Drainage.* Surface drainage can be accomplished by open U-shaped ditches to remove standing or storm water. This type requires attention to keep out vegetation. Sub-surface drainage can be simply accomplished by a trench filled with rock two inches to six inches in size. Fig. 50.

c. *Policing of streams.* Straighten bends, remove pot holes and underbrush. Police edges back for four feet.

d. *Empty water containers* weekly.

2. *Destruction of larvae.* Larvicides such as crude oil, waste motor oil, kerosene, and Paris green are used as follows:

Oiling is a temporary measure. One must maintain a film on the surface of the water and maintain it for two to three hours in order to kill the larvae. For 100 square feet ½ pint of oil will be sufficient. The killing effect is caused by the toxic action of the volatile gasses after inspiration of the oil in the tracheal tubes. Non-volatile oils are ineffective. Waste motor oil, if available, is efficient and cheap. Oil every week. The following oiling methods may be used:

a. The *knapsack* sprayer consists of a container for oil, a pump and a spray nozzle. It holds about five gal-

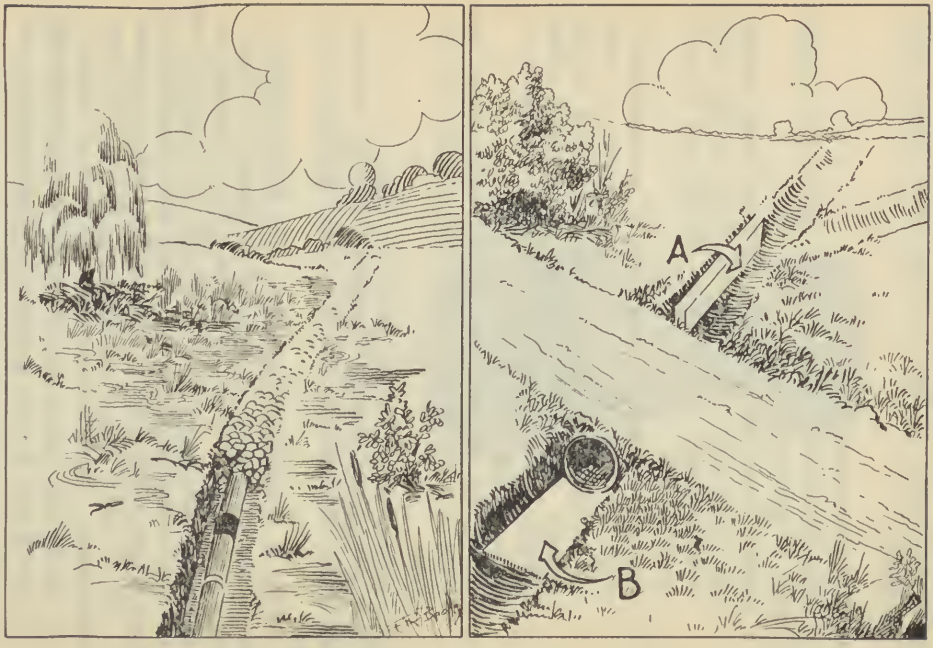

Fig. 50. Drainage ditches used in mosquito control. Left, tile ditch back-filled with rock. Right, open ditch; A, B, protection of bank and floor with concrete.

lons and is operated by one man who carries the sprayer strapped on his back. Range 25 feet. It is used for small ponds, pools and ditches. Fig. 51.

b. *Watering can* method—is a hand method, slow but effective. The nozzle should be fixed so that oil is not wasted.

c. *Drip oiler* is to be used in slow moving streams. It keeps a good film over indentations in stream banks and over stream eddies. It requires little attention. The oil must be adapted to the temperature. The oiler is made from a container, such as a galvanized iron can, 5-gallon oil can or bucket. A hole is made in the bottom of the container. A nail is wrapped with gauze and is inserted through the hole. This acts as a wick or regulator. Place the oil in the can and set it on boards over the stream to be oiled.

Fig. 51. The use of knapsack sprayer as an oiler.

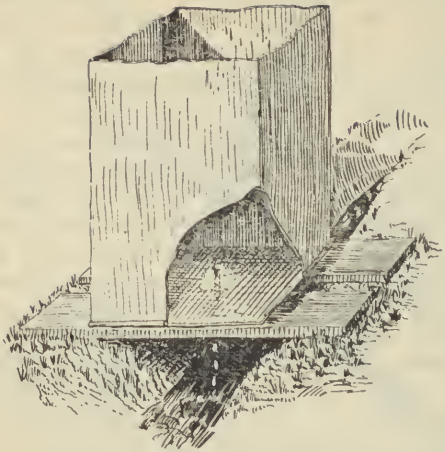

Fig. 52. Drip oiler.

Regulate the flow to 20 drops per minute for each foot width of stream to be oiled. The oiler may be placed on a moored raft or float. Fig. 52.

d. *Submerged oiler*—Fill an ordinary burlap grain sack with oil-soaked sawdust; weigh down with rocks to sink and moor it, and place sack in the stream. Oil comes off gradually and maintains a film for about one week.

e. *Paris green*—Mix one part thoroughly in 100 parts of road dust. Apply to lakes, ponds, or streams by hand casting. It may also be spread by a blower or by spreading from an aeroplane. This procedure is only of value against the Anopheles mosquito larvae. Apply every week to prevent development of new larvae.

One-half ounce of Paris green diluted with 100 times its volume of road dust will be sufficient for

1000 square feet of water surface. In this amount it will not harm fish. While this spray is poisonous due to the arsenic contained, it is not dangerous for men to handle. The spray is difficult to use in vegetation and to apply during rainy, damp weather. Figs. 53 and 54.

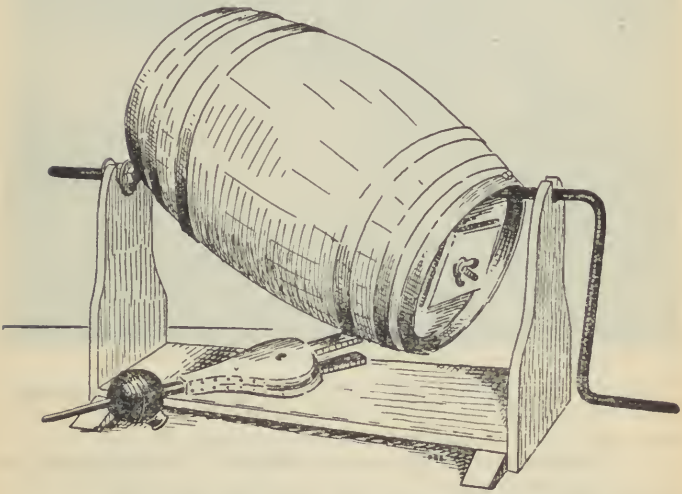

Fig. 53. Equipment for mixing and applying Paris green larvicide.

f. Stock slow-moving streams or ponds with *fish* that eat larvae.

3. *Destruction of Adults.*

a. *Swatting*—is of most value at twilight and just after daybreak. Mosquitoes collect on screens, doors and windows. Use the ordinary fly swatter.

Fig. 54. Application of Paris green larvicide with a Savage duster.

b. *Spraying*—is of value in buildings. The following is a good spray:

Pyrethrum tincture (20 parts powdered pyrethrum blossoms to 100 parts alcohol).	480
Potassium hydroxide soap (Odorless).	180
Glycerine	240

Mix well. To use, dilute 20 times with water and spray walls with small spray pump.

c. *Hand catching* is effective within a building. Use a large test tube 6″ x 1″ x 1″ with an easily removed

cork. Fill the bottom of the tube with rubber bands which have been saturated with chloroform. To operate, remove cork and place over the resting adult mosquito; it will be stunned by the chloroform vapor and drop to the bottom of the tube. Search for mosquitoes under window ledges, in closets, behind objects hung on the wall and in other darkened places where Culex and Anopheles hide during daylight. A flashlight is an aid. Fig. 55.

4. *Protection of the Individual.*

a. *Screening*—is of value if maintained perfectly; otherwise it is useless. Eighteen mesh openings to the lineal inch are required to keep Aedes mosquitoes out. Screen doors should open outwards and be on good spring hinges. Vestibules, if screened with double doors are useful.

b. *Mosquito nets.*—are to be used on beds in all areas when mosquito-borne diseases are endemic. Their use must be enforced by the unit commander. They may be used on T bars or suspended from the inside or over the outside of the shelter tent. No part of the net should touch the sleeper. They must be tucked in on all sides while sleeping. During the daytime they must be rolled. They should be inspected regularly for holes, ripped seams and tears. Particularly in hospitals, the ward man at night should check patients hourly to see if nets are properly adjusted. Nets are to be carried as part of the soldier's equipment in malarial countries.

Use head net and gloves for members of guard and others on duty outside where Anopheles are prevalent.

c. *Quinine Prophylaxis.* A person staying for a short period in malarial countries should use five grains of quinine sulphate daily as a preventive. This can be administered for a month with no ill effects and will

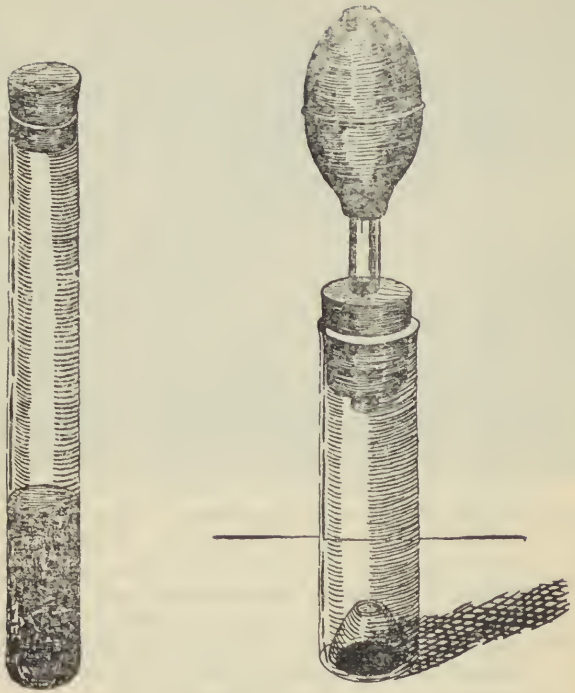

Fig. 55. Mosquito catching tubes. Left, killing tube containing rubber bands saturated with chloroform. Right, suction tube.

lessen the chances for development of the symptoms of malaria for that period. A commissioned officer must check to insure that the men are taking the quinine.

d. *Deterrent.* One may use the following as a deterrent:

Epsom Salts ..... 1 part.
Water ..... 10 parts.

Daubed on the skin and allowed to dry will keep adult mosquitoes away.

RESUME

The control of mosquito borne diseases is based upon the following procedures:

1. Elimination of breeding places.
2. Destruction of mosquito larvae and adults.
3. Protection of man from the bites of mosquitoes.
4. Thorough treatment of all cases and carriers of mosquito borne diseases.
5. Isolation of carriers to prevent infection of mosquitoes.

THE LOUSE

LIFE CYCLE:

The life cycle of the louse consists of three stages; the egg, larva and adult. The time for development of the egg is 8-24 days; the larva, 9 days; the adult lives about 30 days.

Egg Stage: The eggs are opaque and yellowish, ovoid in shape, and pin point in size. They are attached to the clothing and to hairs of the body by a cement excreted by the female. Fig. 56.

Larval Stage: The larvae are whitish in color and pinhead in size. They require blood within 24 hours of development and each day, for their existence. Physical characteristics of the larva are the same as of the adult but smaller.

Adult Stage: The adult begins to lay five to ten eggs daily within 24 hours after development and continues to survive for 30 days under favorable conditions of food and tem-

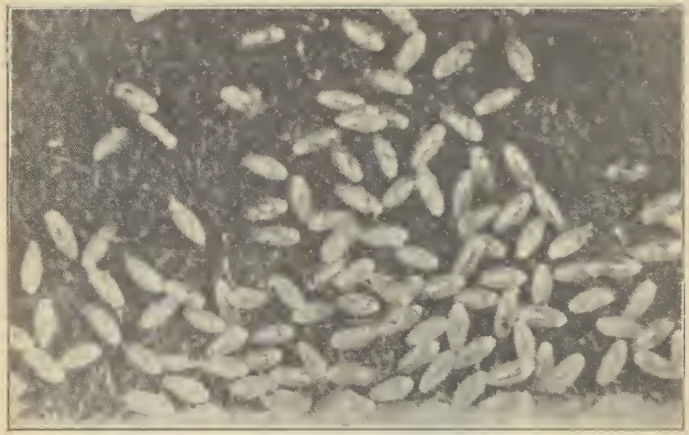

Fig. 56. Eggs of body louse.

perature. One female can produce 4000 off-spring in a month. The adult is 1/16-inch in length and is covered with a hard coat carrying bristles. Figs. 57 and 58.

CLASSIFICATION:

1. Non-blood sucking.
2. Blood sucking.
   (a) Pediculus humanus.
      (1) Pediculus capitis—head louse.
      (2) Pediculus corporis—body louse.
   (b) Phthirius pubis—crab louse.

HABITS:

Through development and environment, the louse has become adapted to various parts of the body. The head louse

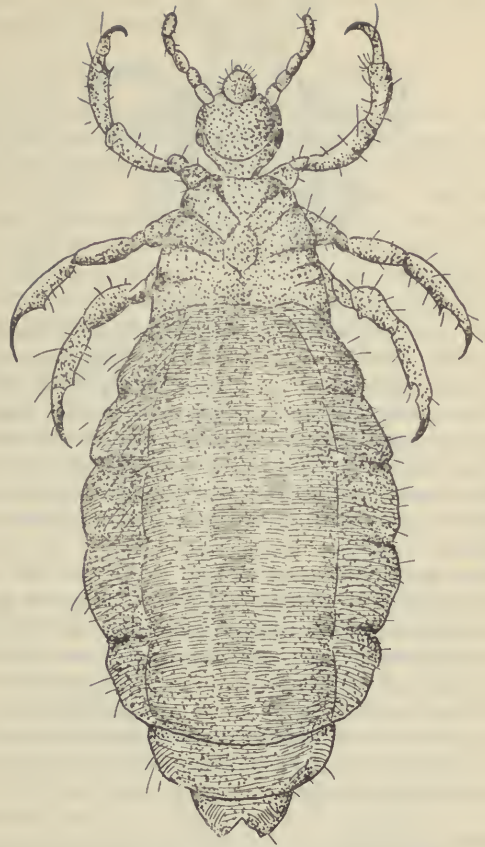

Fig. 57. Body louse.

Fig. 58. Crab louse.

has sought the hairy head of man, the body louse the body, and the pubic louse the genital region. The nits or eggs of the head and pubic louse are found firmly cemented to the hairs of the head and pubis respectively. The eggs of the body louse are attached to fibers of cloth in the seams and also to body hairs. Pediculus humanus will die of starvation if separated from its host and thus deprived of human blood.

Pediculus pubis will die in two days if separated from its human host.

Lice are greatly affected by heat and cold. The optimum temperature for their activity is between 86 and 90 degrees F. At low temperature they become moribund and die slowly.

At 98 degrees F. they are very active and can live but two days without food. They are extremely active at 104 degrees F. and will die in 12 hours without food.

Dry heat at 131 degrees F. for 30 minutes and at 140 degrees F. in 15 minutes and boiling water for 30 seconds will destroy adult lice and eggs.

DISSEMINATION:

Lice may migrate from person to person in crowded sleeping quarters. Eggs are carried through exchange of blankets

or other clothing. Pubic lice are ordinarily transferred during sexual intercourse and to a slight extent from latrine seats, blankets or clothing.

DISEASE RELATION:

Lice transmit the causative agents of typhus, trench, and relapsing fevers, ingesting the virus as they feed upon patients and excreting it in the fecal material unchanged. These insects are voracious feeders. They require blood meals frequently and defecate freely while feeding. They desert the body of a patient when his temperature is high or death ensues and seek a new host. The virus is not transmitted in the act of blood sucking but is carried into the skin by the scratching caused by irritation of the bite.

CONTROL MEASURES:

The principal control measure is eradication of the louse. When infestation occurs in the presence of louse-borne disease methods must be used which will kill the louse, and the disease producing virus as well. Delousing must be 100% effective throughout the command. During peace-time only such people as live in overcrowded insanitary dwellings are infested. In war where there is necessarily over-crowding, conditions are ideal for lice to flourish. It is, therefore, necessary to carry on wholesale delousing at regular intervals.

Eggs may be dropped off the body in straw, debris, and dust or on blankets, latrine seats, and clothing and thus transferred to other persons.

In order to be effective, measures for the control of lice must accomplish disinfestation of both the individual and the unit to which the infested man belongs. Any slip in the procedure makes the entire measure unsuccessful.

During peace, an individual found lousy should shave all hairy parts, except the head, following by thorough bathing with the use of kerosene soap made as follows:

Boil 1 part of soap in 4 parts of water.
Add 2 parts of kerosene.
Mix with 4 parts of water.

A simple device for bathing can be made from a water sterilizing bag suspended from a scaffold or a tree limb. One faucet of the bag is replaced by a rubber tube in the end of which is placed a short section of pipe closed at one end and perforated in numerous places to act as a shower head. A stone filled soakage pit should be constructed underneath the shower, being covered with boards on which the men may stand. Figs. 59 and 60.

If head lice are present, disinfestation can be accomplished by loosening the eggs from the hairs by the thorough application of 10% acetic acid (vinegar), followed by shampooing the scalp with hot soapy water containing 25% of kerosene. This removes the detached eggs and kills the adult and larval forms. After shampooing, the hair should be combed with a fine toothed comb to remove any nits not removed by washing. Where practicable the hair should be clipped short. This entire treatment should be repeated in ten days.

Clothing of the infested man should be treated in a pressure sterilizer or, if such is not at hand, a Serbian barrel may be used. Clean clothing should be issued in lieu of disinfestation of old. Where practicable one month of storage of infested clothing will kill all eggs, larvae, and adult lice.

In any command, war or peace, every man joining or leaving that command should be inspected and if found lousy should be disinfested. Company officers should conduct a weekly inspection for lice.

During war and in the theatre of operations routine delousing programs should be conducted. Large mobile disinfestors can be used which makes it possible to delouse an entire division in a week's time. At embarkation and debarkation points, smooth functioning, elaborate delousing plants are usually constructed.

Fig. 59. Shower bath improvised from water sterilizing bag. Inset, spray

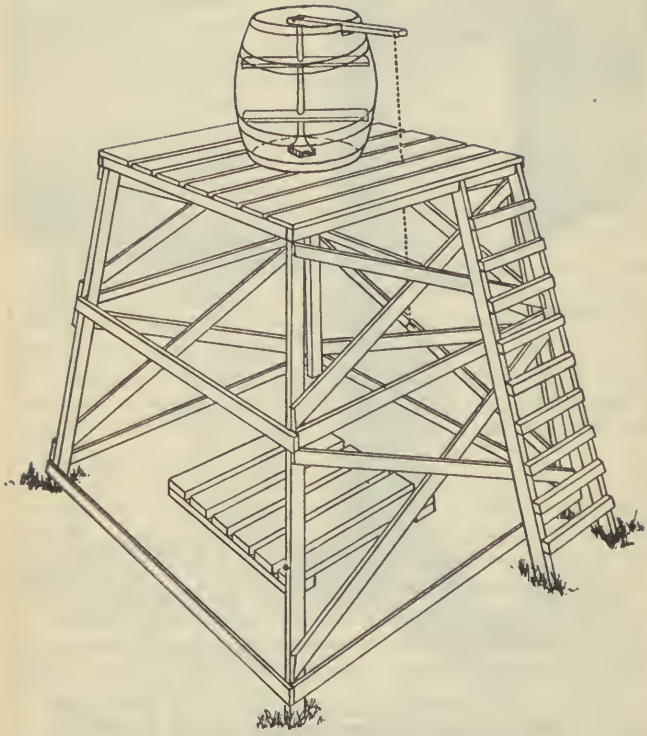

Fig. 60. Improvised shower bath.

The principles underlying delousing are:

Destruction of lice.
Destruction of eggs.
Destruction of the virus of louse-borne diseases.
Thorough cleanliness of person and clothing.

Lice and eggs are killed and the virus transmitted by lice are destroyed:

At 131°F. in five minutes.
At 155°F. in one minute.
At 212°F. (boiling) in ½ minute.

METHODS OF TREATING CLOTHING:

1. *Hand Ironing.* After removing as many lice as is possible by hand, the clothes are pressed with a flat iron. This method is quite effective but too time consuming except for individuals.

2. *Boiling.* Where practicable, clothing made of cotton, linen, and silk may be boiled for five minutes.

3. *Chemicals.* Leather, belts, shoes, and hats which cannot be disinfested by other means should be immersed in a 5% cresol solution for 30 minutes. Leather goods seldom need disinfestation, however.

4. *Serbian Barrel.* Figs. 61 and 62. Consists of a barrel or a similar container for the material to be disinfested, below or in the lower part of which there is a receptacle for water and an improvised furnace or fire box.

The galvanized iron garbage can is usually the most practicable and no separate container for water is necessary. Water to a depth of about two inches is placed in the bottom of the can which is placed over the fire. A wooden grate supported on sticks about one foot in length should be placed in the bottom of the can to hold the clothes above the water. Hooks on which to hang the clothes may be bolted or riveted into the lid or "S" shaped wire hooks may be hung over the

Fig. 61. Disinfestor, Serbian barrel type.

edge of the can. Clothing should be left in the can for 45 minutes after steam commences to escape. Air dry after removal and reissue to the men. This method will kill all the eggs, larvae, and adult lice. During this 45-minute period all men should be thoroughly bathed, using plenty of kerosene soap and warm water.

5. *Storage.* This method may be used where practicable. Store in a dry place for 30 days, keeping accurate records of time.

RESUME

To prevent louse-borne diseases:

1. Weekly inspection for lice.
2. Frequent bathing.
3. Disinfestation of men and clothing if infested.
4. Wearing of clean clothes.

Fig. 62. Disinfestor, Serbian barrel type. Showing water pan, and grating in the bottom of the barrel.

CLASSIFICATION:

The common wood tick, Fig. 63, is the most important tick found in the United States, in so far as transmission of disease to man is concerned. This tick is the vector for Rocky Mountain spotted fever. In endemic areas it is estimated that one per cent of wood ticks harbor the spotted fever virus. It is also one of the agents by which tularemia is transmitted from animal to animal and from animal to man. It is found quite generally throughout the United States.

Fig. 63. Adult wood tick.

It is possible that the rabbit tick and dog tick are concerned in the transmission of Rocky Mountain spotted fever.

Ticks have been found to be the transmitting agent of relapsing fever in Central America, Venezuela, and Columbia.

HABITS AND CHARACTERISTICS:

The developmental forms of the tick consist of the egg, larva, nymph, and adult. The tick deposits several thousand eggs in a mass on the ground. The egg stage lasts from three

to four weeks to several months, depending on the temperature. The larvae as they emerge seek a warm blooded host upon which they feed for two to four days. They then drop to the ground where they remain dormant for several weeks. They moult and become nymphs which again seek a warm blooded animal upon which to feed for four to eight days. The nymph then drops to the ground, where, after a lapse of several weeks, moulting occurs and the adult emerges. The adult searches for a host, finds one, attaches itself, feeds for a while then copulates. After ten days to two weeks the gravid female drops to the ground, deposits her eggs and dies.

Adult ticks can live for two years without food. Cold delays the development of the immature forms but extremely cold weather will not kill ticks in any stage, nor will it destroy the virus of Rocky Mountain spotted fever.

TRANSMISSION OF DISEASE:

Ticks are able to transmit the etiological agents of Rocky Mountain spotted fever, relapsing fveer, and tularemia through the egg stage to the progeny, any stage of which is capable of inoculating the host with the causative organism.

CONTROL OF TICKS:

Control of tick-borne diseases by the eradication of the tick is difficult to achieve and is, in many instances, impracticable. Buildings of little value and infested with ticks should be burned. If found desirable, a kerosene or cresol insecticide may be applied to tick infested floors, walls, ceilings or furniture. It should be applied in the same manner as described under control of bedbugs.

Control of the tick must be attained mainly by control of its wild animal hosts. As the larval and nymph forms feed principally on the smaller animals, such as squirrels, rabbits, prairie dags, or woodchucks, the eradication of these animals from an infested area is an important factor in tick control. How can this be accomplished?

1. By cultivating suitable land and the burning of underbrush which will reduce the number of the animals and will also destroy some of the ticks.
2. By trapping, shooting and poisoning of the wild rodents in infested areas.
3. Sheep grazing is a valuable measure. When ticks attack sheep many of them become entangled in the wool and are unable to escape or obtain a blood meal.
4. A small gnat like insect, Ixodiphagus caucurtei, is parasitic upon the tick and destroys it. These have been distributed in certain regions where Rocky Mountain spotted fever is prevalent for the purpose of parasitizing and destroying the ticks.

BEDBUGS

Bedbugs, Fig. 64, exist wherever they can live in close association with man. They frequently become a serious pest in barracks and guardhouses. While it has not been proved that bedbugs transmit any disease to man, they have been suspected of transmitting relapsing fever and leishmaniasis. Because they are blood sucking insects, however, it is possible that they may transmit any disease in which there is a blood stream infection.

HABITS AND CHARACTERISTICS:

Bedbugs develop through the egg, larva, and adult stages. The eggs are white, oval in shape and about one mm. long. They are deposited in cracks, crevices and any place which affords protection and concealment. In warm weather the eggs hatch in 4 to 10 days but development may be prolonged or prevented by cold. The larvae are yellowish white in color and resemble the adult, except in size and color. Blood is required for the development of the larvae. Time for development is 6 to 11 weeks dependent upon food and temperature.

Fig. 64. Adult bed bug.

Bedbugs are nocturnal in their feeding habits. They are capable of surviving for six months or more without food. They are very sensitive to high temperatures and all forms, including the eggs, are killed in a few minutes by exposure to a temperature of 113 degrees F. in a humid atmosphere. They are killed by prolonged exposure to a temperature below freezing.

DISSEMINATION:

Bedbugs are usually spread from place to place in clothing, bedding, baggage, or furniture. They hide in the seams of mattresses and pillow cases; in cracks and crevices of any wooden or metal structure.

CONTROL MEASURES:

Fumigation is the most effective bedbug control measure, provided a gas is used which will penetrate into the depths of the cracks and crevices in the walls, floors, and furniture. Hydrocyanic acid gas is penetrating and, when properly used as a fumigant, it will destroy all forms of the bedbug. However, the gas is fatal to humans as well and unless a rigid guard is maintained at all times its use is impracticable and dangerous. Sulphur dioxide may be used but because of its low penetrating power and destructive action upon fabrics, it is not particularly satisfactory.

Liquid insecticides are effective if thoroughly and repeatedly used. An effective mixture for this purpose is kerosene containing 10 per cent of cresol or 5 per cent of turpentine. Kerosene alone may be used. A kerosene or alcoholic extract or pyrethrum is also effective. A paint brush should be used in the application of the liquid insecticide. A spray is not as effective. This procedure should be repeated three or four times at intervals of one week to kill all developing eggs. Steam should be used to eradicate bedbugs from mattresses, blankets and other bedding. Dry cleaning with gasoline and washing in hot water will usually get rid of them. Hand picking, brushing and shaking is recommended. Flaming the cracks of steel cots with a blow torch is quite effective. Kerosene may be used as a repellant by saturating with it wicks of woolen material placed in the coilsprings of metal cots. Fresh applications of kerosene should be made weekly.

SECTION V.

VENEREAL DISEASES

PREVALENCE:

This group of diseases ranks second to respiratory diseases as a cause of admission to sick report in the Army.

The great reduction in the occurrence of these diseases has been due to the following:

1. An efficient prophylaxis.
2. More educational and recreational opportunities.
3. Laws which discourage carelessness as to prophylaxis.
4. Unit pride.
5. Increased interest of commanding officers.

Further reduction in occurrence can be brought about by:

1. Maintaining excellent prophylactic stations.
2. Closer contact of noncommissioned officers and privates.
3. Men reporting sources of infection, prostitutes.
4. Men taking prophylaxis immediately after exposure.
5. Districting certain areas, patroling by Military Police and requiring every soldier found leaving the area, as well as those intoxicated, to take prophylaxis.
6. Education on venereal diseases.
7. Cooperating with boards of health, local and state.

CLASSIFICATION:

The principal venereal diseases are:

1. Syphilis; caused by a corkscrew shaped organism—Treponema pallidum.
2. Chancroid; caused by a bacillus—the bacillus of Ducrey.

3. Gonorrhoea; caused by a coffee-bean shaped diplococcus—the gonococcus.

CONTROL:

Every case must be subjected to treatment. Cases may be placed in the hospital, in working quarantine, or be restricted to the post, as recommended by the surgeon. A partially cured soldier may easily infect women who in turn infect numerous other soldiers and keep the rate in a command high. Partially cured men restricted to the post should be carefully watched to see that they do not break restriction.

Prophylaxis must be carried out in the field as in garrison. The locations of prophylactic stations will be given in the sanitary orders and company commanders should be certain that their men are informed thereof.

To lower excessively high rates among enlisted men, stringent measures must sometimes be enforced such as:

1. Placing all red light districts and all places selling alcohol, *out of bounds.*
2. Bed check.
3. Classified passes.
4. Limit all passes to four hours and none after 9:00 P.M.
5. Patrolling of red light districts by Military Police.
6. Increased frequency of physical inspection.

PROPHYLACTIC STATIONS:

1. Locate conveniently so that men can take prophylaxis at least within an hour after exposure. Noncommissioned officers can easily locate the most convenient sites for stations.

2. A noncommissioned officer must be placed in charge of the station. This noncommissioned officer must not only be thoroughly familiar with, but must carefully instruct his assistants (enlisted privates) in:

a. The value of surgical cleanliness and sterilization.
b. The characteristics of the germs causing the venereal diseases.
c. How these diseases are transmitted, their symptoms and usual course.
d. How to prepare the necessary solutions.
e. How to give prophylactic treatment explaining the reasons by a description of the male genital tract.
f. Constantly keeping everything connected with the station absolutely clean, and promoting good morale among his assistants.

3. *Materials.* Required as part of a dispensary whether in the field or in garrison.

a. Protargol solution, 2% freshly prepared weekly. Keep in amber colored bottles.
b. Bichloride of mercury solution, 1 to 1000. Is poisonous. Does not deteriorate.
c. Sufficient calomel ointment, 30%. Well mixed. Does not deteriorate.
d. Sufficient liquid soap in a bottle with a shaker top, made by inserting a glass tube through the cork.
e. At least one dozen serviceable penis syringes. Keep in a closed jar.
f. Tongue depressors. Keep in a closed container. To be used to remove the calomel ointment from the jar.
g. Sterilizer for syringes. They must be washed thoroughly in soap and water, then sterilized by boiling for five minutes.
h. Sponge holder, to be used by soldiers in removing syringes, tongue depressors, gauze and sponges.
i. Running water; or, at least one dozen wash basins.
j. Sufficient 2-oz. medicine glasses, into which protargol is poured before use by the soldier.
k. A clock.
l. Roll of absorbent paper.

m. Towels, linen or paper.

n. Large, easily read labels for everything the soldier is required to use.

o. Well lighted room, preferably with an ante-room as a waiting room, and a small adjoining room or booths with either a large trough with running water or individual porcelain troughs in each booth.

p. Sufficient blank forms No. 77, M.D., to be made out properly and kept on file for at least three months. When the soldier receiving prophylaxis is from another organization, send a duplicate copy of Form 77, M.D., to his commanding officer next day.

q. Place to wash hands.

4. *Prophylaxis*: The prophylaxis must be given by a trained attendant. Directions should be posted in each station.

a. Examine penis for signs of venereal disease.

b. Have soldier urinate and wash his hands.

c. Wash penis, scrotum, and adjacent area of the body thoroughly with liquid soap and warm water. Flush off with 1-1000 bichloride solution.

d. By means of a syringe inject a teaspoonful of 2% protargol into penis. Have soldier close the opening with his thumb and finger and retain the solution for 5 minutes by the clock. Too much pressure must not be placed at the end of the penis. This is where the germs if present are likely to be most numerous. Release pressure very slightly at intervals to allow for thorough bathing of end of opening.

e. Pull back the foreskin; thoroughly rub into the penis and surrounding body area about a teaspoonful of calomel ointment, 30%. Rub in for at least 3 minutes. Wrap penis in a towel or paper. Instruct the

soldier not to urinate for at least 4 hours.

f. If the time since intercourse is longer than 3 hours, give the regular prophylaxis, but have soldier return twice daily for two days to receive an injection of a teaspoonful of 1% protargol.

g. Complete the prophylaxis slip. Have the soldier sign. File for 3 months.

Reference: AR 40-235.

SECTION VI.

MISCELLANEOUS DISEASES

Tetanus.
Rabies.
Gas Gangrene.
Scabies.
Ringworm.
Plant Dermatitis.

TETANUS

Wounds contaminated with soil or street dust and especially those puncture wounds in which foreign bodies have been lodged are most apt to harbor the tetanus bacilli. Tetanus is seen often in compound fractures, gunshot wounds, and in cases of extensive burns.

The vegetative tetanus bacillus is readily destroyed by ordinary disinfectants. The spore or resting form is extremely resistant and can withstand a temperature of 176 degrees F. for at least an hour. They can live in the soil for years and can be carried long distances in dust. Growth or reproduction occurs when circumstances become favorable such as the heat, moisture, and absence of oxygen found in wounds.

Importance. Susceptibility is universal. The mortality may be as high as eighty per cent in untreated cases. The size or appearance of a wound is not related to the severity of the disease. Prophylaxis is of supreme importance.

Control Measures. Active "safety first" advice and the teaching of first aid methods will help prevent injuries.

Specific control depends on the care of the wound and administration of tetanus antitoxin.

1. Antitoxin should be given subcutaneously in all cases of wounds or injuries where there is any possibility that tetanus organisms might have been carried into the wound. This should be done as soon as possible after the injury. The usual dose is 750 units for children and 1500 units for adults.

2. Serum reaction or anaphylactic shock should be watched for. Give a small initial dose intracutaneously and repeat in thirty minutes, having at hand a syringe containing 1:1000 adrenalin solution. If no reaction occurs the remainder of the dose may be given.

3. Untreated septic wounds should be opened, swabbed with three per cent iodine solution and lightly packed with gauze. If the wound is partly healed over, do not disturb it unless a foreign body is suspected. Fresh wounds should be thoroughly cleansed with a three per cent alcoholic solution of iodine, all foreign bodies, frayed or macerated tissue removed and the edges lightly packed so that the wound remains wide open.

RABIES

Rabies is a communicable disease of animals transmissible to man. It may occur in any animals but is most prevalent among dogs. In the dog the disease occurs in two general forms:

1. The furious or excited type in which the animal runs wildly about and bites any nearby object, person, or animal.

2. The dumb or depressed type produces early muscular weakness and finally paralysis.

Many animals exhibit mixed symptoms, but the furious type predominates in about 80 to 85 per cent of cases in dogs.

Transmission. Usually the virus or organism of rabies is transmitted by inoculation of saliva through a wound or abrasion of the skin or mucous membrane. The saliva is injected into the skin by biting but it may be transmitted by the licking of injured skin surfaces or by handling sick animals. The organism cannot be transmitted through unbroken skin, by ingestion of contaminated food or drink, or by contaminated fomites. While the disease occurs in cats, squirrels, rats, wolves, coyotes, foxes, horses, cattle, sheep, and swine, these animals are not common sources of infection for man.

From 15 to 60 per cent of persons bitten by rabid dogs develop the disease. The mortality is very high.

Control Measures. Control of rabies depends on (1) the prevention of the disease in dogs; (2) treatment of wounds; (3) prophylactic treatment to prevent the development of the disease.

Dogs can be protected against rabies by specific vaccination which should be repeated each year. A metal tag giving the date the treatment was given should be attached to the collar of the dog.

When a case of rabies develops in any dog or where any dog is exposed or suspected of being exposed to the infection, two doses of the vaccine should immediately be given and the animal held in quarantine for one month. Where dogs cannot be vaccinated, any dog exposed or suspected of being exposed to the rabies infection should be held in quarantine for at least six months.

Wound Treatment. The wound should be opened wide and all macerated tissue removed; free bleeding should be encouraged. Every part of the wound, including all pockets and recesses, should be cauterized with fuming nitric acid. Application should be carefully made with a glass rod. Concentrated nitric acid, phenol, or formaldehyde can be used as substitutes for the fuming nitric acid but they are not as

effective. The ordinary disinfectants such as iodine are of little value. A general anesthetic may be given if necessary.

Vaccine. In districts where rabies is present the prophylactic treatment should be given to all persons who are bitten by stray or unknown dogs. The dog should be captured and observed for ten days. If the disease fails to develop in the dog in this time the course of treatment can be discontinued. The immunity conferred by one dose of the vaccine is short, therefore if a person is again bitten the treatment must be repeated.

GAS GANGRENE

Gas gangrene is an acute infection, occurring in large macerated wounds contaminated with human or animal waste found in soil. The infection is associated with compound fractures and large crushing or tearing wounds that come in contact with the soil, but it has occasionally followed puncture wounds or small abrasions. Once the disease develops it is extremely difficult to control. The mortality is very high.

Prevention. Every extensive wound should receive the best of attention, the patient being placed in hospital.

Treatment. In mild cases the wound should be cleaned of all discolored, frayed or devitalized muscle or skin tissue. It may be necessary to sacrifice entire muscles. The wound should be left open. Irrigation and cleaning of the wound should be frequent. In advanced cases extensive excisions or amputations may be necessary.

Antitoxic sera should be used as a prophylactic in all wounds where contamination with gas bacilli is probable.

SCABIES

Scabies, also known as seven year itch, is an acute inflammatory condition of the skin due to the presence of the Sarcoptes scabiei or itch mite.

The female is responsible for the disease as she burrows into the skin in order to lay her eggs, while the male remains on the surface. After laying from twenty-five to fifty eggs she usually dies. The eggs hatch in about five days. The larval and nymphal forms pass through four stages to become adults in about three weeks. The larvae also bore into the skin to find protection and food. The activity of the mites is greatly influenced by the temperature. Active burrowing takes place only when the skin is warm. The newly matured females and the males are found under the scales and crusts of the skin.

Importance. Scabies is an important condition because of its adverse effect on the morale and efficiency of the individual or groups. It entails an average loss of time of about ten days in cases admitted to quarters and hospital. Complicated cases are frequently in hospital for several weeks.

Transmission. The source of infestation is the person with scabies. Direct body contact is the common mode of transfer but indirect contact through clothing, blankets or equipment may occur. Clothing from infested individuals may harbor the live parasites for at least eleven days.

Symptoms. Itchiness between the fingers and upon the back of the hands is usually the first symptom. The parts most affected are the webs of the fingers, backs of the hands, occasionally the palms, flexor surfaces of the wrists and arms, lower part of the abdomen, the buttocks, the inner surfaces of the thighs, and the genitals. The lesions are rare upon the feet. The primary lesion is a vesicle or papule. Burrows are not found in all cases; they are most common between the fingers. They consist of straight or tortuous lines, from

⅛ to ½ inch in length and ending in a slight elevation. Along the lines are numerous black dots, the excreta of the female. The itching is usually intense, and is especially bad at night.

Diagnosis. The correct and prompt diagnosis of scabies is essential in the control of this infestation. When scabies is known to be present in a command, there is frequently a tendency to consider all skin irritations as scabies. Treatment should not be given unless scabies is actually diagnosed. The typical burrows and vesicles are pathognomonic of scabies, but the diagnosis may be confirmed by finding the parasite in the burrow. Frequently a hand lens is a valuable aid in finding the mites. The location of the lesions on the hands, wrists, elbows, knees, and genitals aids in differentiating scabies from the scratch marks and irritation due to body lice.

CONTROL MEASURES:

General. Eradication of existing infestation depends on proper diagnosis, disinfestation of skin, clothing and blankets. The spread of scabies from infested recruits or isolated cases is controlled by securing body cleanliness, cleanliness of clothing and blankets and by preventing overcrowding.

Special Measures. Group quarantine should be established for all patients until treatment is completed. Men who have received treatment should be reinspected ten days after completion of the treatment to be sure all infestation is destroyed. The clothing and blankets of men having scabies should be disinfested by the method employed for delousing. This should include gloves and shoes.

Disinfestation of the Skin. Disinfestation of the skin is accomplished only by treatment that destroys all forms of the parasite. Bathing with hot water and free use of green soap, well scrubbed in for ten or fifteen minutes is essential to re-

move the crusts and scales. The soap is then removed with hot water and the body thoroughly dried. Sulphur ointment (USP) is then thoroughly applied to the entire body, from the neck to the tips of the fingers and toes. It should be well rubbed in. This treatment is repeated on the following day and in badly infested cases, on the third day. A cleansing bath then concludes the treatment. However, failures are frequent and a careful inspection should be made for evidence of the parasite before the patient is discharged. As a substitute for sulphur ointment, lime and sulphur lotion may be used. Occasionally a sulphur dermatitis may result from the treatment.

RINGWORM

TINEA TONSURANS:

Tinea tonsurans or ringworm of the scalp is a very persistent form of infection. It is characterized by one or more, rounded, scaly, grayish-colored patches through which project dry, brittle, broken off hairs. The patches are not well circumscribed; they spread peripherally and often coalesce to form large areas, often as large as the hairy scalp. Slight itching may be present. Salicylic acid ointment is the best form of treatment.

TINEA BARBAE:

Tinea barbae or ringworm of the beard is a contagious disease manifesting itself by follicular lesions upon the chin, neck, and submaxillary regions. The individual follicles are small and usually superficial; the hair over them is stubby and bathed in a discharge of pus. The nodules tend to be arranged in groups, each group separate from the other. The disease is very chronic, tends to cure spontaneously with the loss of hair and when cured leaves no traces.

The use of antiseptic ointments such as ammoniated mercury is the best form of treatment. The hairs should be epilated.

TINEA CIRCINATA:

Tinea circinata or ringworm of the body develops as one or more rounded, red slightly elevated scaly patches, which on close examination reveal minute vesicles or papules. The typical advance is from the periphery, while the central portion clears up. There is often considerable itching. Ammoniated mercury ointment will usually terminate the infection promptly.

TINEA CRURIS:

Tinea cruris also known as Dhobie itch or ringworm of the inguinal region, is a chronic contagious infection. The inner sides of the thighs, the groin, the gluteal cleft, and the skin between the toes are the common sites for the infection. The axillae are occasionally involved. The lesions are usually two or more in number, large in size, brownish in color, with an elevated slightly inflammed edge, which is well defined. Recurrences of this disease are very common. Tincture of iodine, chrysarobin ointment, and salicylic acid in ointment form or as a strong alcoholic solution are used as treatment. Ultraviolet light may produce good results.

DERMATOPHYTOSIS:

Dermatophytosis (athlete's foot) or ringworm of the hands and feet is a very common condition. No one organism is responsible for all cases. Relatively severe infections may incapacitate the individual for the performance of duties.

Transmission. The causal agents of ringworm of the extremities are usually transmitted by indirect contact with inanimate objects. However, the primary source of infection is

the infected individual. The common mode of dissemination is by contact made by the skin with floors, mats and benches, of bath houses and swimming pools and by handling infected equipment in gymnasiums and clubs. Towels, soap, shoes, and other articles used next to the skin may harbor the causative organisms.

Symptoms. The disease usually starts as scaling between the toes, then crops of vesicles, usually associated with intense itching, appear between the toes or upon either the soles, dorsal surface of the feet or ankles. Within a few weeks this condition may completely change to one of chronic scaling. Acute exacerbations occur at varying intervals. Excessive moisture of the feet associated with hot weather or wearing of wool stockings not infrequently starts an attack.

CONTROL MEASURES:

1. *Disinfection.* The most effective measure in the control of this disease is disinfection of bath house floors and equipment and by the sterilization of towels, swimming or gymnasium suits, and similar articles that may harbor the infection. Bath house floors and equipment should be scrubbed daily with strong soap suds. There should be removable standings (duck-boards) in shower baths which should be made in small sections so that they may easily be taken out and exposed to the sunlight for several hours each day. Articles that can be boiled should be sterilized by boiling. Rubber and leather goods can be cleaned with cresol solution. A one per cent solution of thymol in gasoline or alcohol will disinfect shoes. The solution should be poured into the shoes and allowed to evaporate.

2. *Inspection of Feet.* The feet of all men should be carefully inspected at the regular monthly inspection. Where a considerable number of cases are present, special inspections should be made for the purpose of detecting mild cases.

3. *Sanitation of Swimming Pools.* Swimming pools to which troops have access should be considered satisfactory only when regulations and facilities thereof provide:

a. A restriction as to the current number of bathers.

b. For thorough cleansing of the body prior to entering the pool.

c. For the use of a disinfecting solution, calcium hypochlorite or sodium hyposulphite for the feet.

d. Exclusion of those who are ill.

e. Continuous disinfection of the pool water.

4. *Treatment.* Numerous forms of treatment have been advocated for this condition.

a. All affected areas should be kept clean by scrubbing with soap and water, especially before the application of any drugs.

b. Dryness of the skin should be promoted by the use of powders, exposure to air and frequent change of clothing.

c. Excess hair should be removed.

d. Strong solution of salicylic acid in alcohol, Whitfield ointments and ammoniated mercury ointment are the drugs commonly used.

5. There is great danger of recurrence from insufficient treatment.

6. A moist condition of the skin, whether produced by warm weather or wearing woolen clothing, retards treatment. Bathing the feet for one half hour daily in formaldehyde solution, 1-1,000 or potassium permanganate solution 1-3,000 is recommended when excessive moisture of the skin is present.

PLANT DERMATITIS

General. The poison ivy, poison oak and poison sumac are the common plants that produce skin irritation in susceptible people.

The poison ivy is distinguished from other suspected creepers of a similar appearance by its possession of three leaves instead of five.

The poison oak, which grows especially in the western part of the United States is a shrub or small tree.

The poison sumac, also known as poison elder or dogwood, is a shrub or small tree growing in swampy places.

Transmission. The harmful part of these plants is the resinous sap which exudes from all injured surfaces. It is now certain that the poison is not volatile, as was once supposed. Actual contact with the sap is necessary; however, contact with the plant may not be essential as the sap can be carried on clothing, tools, hands or transmitted on the bodies of insects or in the smoke coming from fires burning the plants. Sap particles carried in any of these ways soon lose their toxic properties by oxidation. This loss is more rapid at body temperature and in a moist atmosphere. The poison is soluble in alcohol and alkalies.

Symptoms:

General. The clinical manifestations appear within a few hours after exposure and within twenty-four hours there is a marked cutaneous irritation. The lesions are most marked on the back of the hands and forearms; the face is usually involved, either primarily or secondarily. In men the penis is often involved, due to the poison being conveyed by the hands.

Lesions and Course. At first there is a marked erythema with some swelling, but in a short time numerous tiny vesicles appear. These may coalesce to form large vesicles. Often they are in rows, due to scratching. Within two to four days the lesions rupture leaving a weeping raw surface which goes on to form a dry crust. As the vesicles are superficial, complications seldom occur and the patient is usually well in two weeks. The subjective symptoms are generally

severe with intense burning and itching and a feeling of increased tension of the skin.

General Control Measures. Learn to recognize the plants and avoid them when possible. Destroy the plants in occupied areas. Avoid contamination in camps by requiring all men working in or about the plants to:

1. Wear gloves while at work.
2. Change outer clothing and gloves before associating with the other men in the camp.
3. Keep contaminated tools and implements separate.
4. Burn poisonous vegetation at a considerable distance from the camp site and always at such time and place that the wind will carry the smoke away from the camp.
5. If possible choose camp sites where poisonous plants are not present.

Personal Measures:

1. Contaminated clothing and implements should be well washed with water (soda water if possible) or exposed to the direct rays of the sun for several hours.
2. All parts of the body that have been exposed to the plants should be well washed with a strong soap solution or alcohol. Gasoline or kerosene may be used. The washing must be prompt and thorough or else it will tend to spread the poison.

   Where the lesions are more than 24 hours old it is best to apply a weak solution of potassium permanganate or ferric chloride. The lesions are then best treated with a mild lotion such as calamine, or a soothing powder.

SECTION VII.

NOTES ON FIRST-AID

First aid is temporary emergency treatment given in a case of sudden illness or accident BEFORE the services of a physician can be secured. In many cases this temporary care, if intelligently given, will save a life. In all cases, properly rendered first-aid, will reduce suffering and place the patient in the physician's hands in a better condition to receive treatment.

GENERAL DIRECTIONS

Keep the patient lying down in a comfortable position with the head level, until the extent of the injury is determined.

Keep the patient warm, be sure the patient is covered on the under side.

Do not give any liquid to an unconscious patient, as it may enter the windpipe and strangle him.

Be sure nothing is done to further injure the patient, keep cool yourself, dō not move the patient hurriedly or roughly, keep onlookers away from the injured.

WOUNDS

A wound is a break in the skin or in the lining membrane of one of the body cavities.

Incised wounds are made by sharp cutting instruments such as a knife, broken glass or razor.

Lacerated or torn wounds are caused by blunt instruments such as machinery, exploding shell, or falls against angular surfaces.

Puncture or stab wounds are produced by penetrating instruments such as nails, wire, bullets.

The two great dangers from any wound are infection and serious bleeding. Whenever the skin surface is broken, regardless of how small the wound may be, germs may enter and cause infection. Never touch a wound with anything unclean, such as dirty fingers, unclean bandages and instruments. Rapid bleeding requires immediate attention.

WOUNDS IN WHICH BLEEDING IS NOT SEVERE:

The chief duty in these cases is to keep the wound clean and prevent infection. If any antiseptic such as iodine is available, apply this gently to the wound and to the skin for an inch beyond its borders. Allow this to dry, then apply a clean dressing.

DO NOT:

1. Touch the wound with the hand, mouth, clothing or any unclean material.
2. Wash the wound with soap and water as this will carry more germs into the wound.
3. Squeeze or massage bad wounds, you may do more damage.
4. Remove blood clots or explore the wound with any object.
5. Re-apply iodine. Never use iodine in the eyes or body cavities.

WOUNDS WITH SEVERE BLEEDING:

The first duty in these cases is to stop the bleeding. To do this first think of pressure.

Immediately apply pressure with the fingers or hand between the cut and the heart. A tourniquet is preferably used with a pad over the artery, the tourniquet itself should be at least 1 inch in width; never a rope or wire. This is a dangerous procedure and should not be used if bleeding can be arrested by other means. It cuts off the entire blood supply to the part—*therefore, loosen the tourniquet every fifteen or twenty minutes* but do not remove it. Do not cover the tourniquet with a splint or bandage, it may be forgotten and not loosened as necessary. *Shock* is always present with severe bleeding but no stimulants should be given until the bleeding has stopped.

Sites for applying a tourniquet to control bleeding:

1. For the arm, forearm and hand; around the upper arm about a hands breath below the armpit.
2. For the thigh, leg and foot; around the thigh about a hands breath below the groin.

See pages 166 and 167.

All wounds, especially puncture wounds or injuries caused by powder or dirty objects, are subject to additional danger from infection by the tetanus bacillus (*lock-jaw*). Wounds contaminated by soil are also frequently infected by the bacilli of gas gangrene. In all cases of this nature a physician should be consulted so that the proper care can be given the wound, and, if necessary, serum containing the antitoxin against tetanus or gas infection can be administered.

SHOCK

The term *shock* refers to a condition in which all of the vital functions of the body have been greatly depressed.

This condition usually results from injury but it may be caused by exposure, bleeding, extreme fear, fatigue, or hunger. Some degree of shock follows all injuries, it may be slight, lasting only a few minutes, or it may be prolonged and end

fatally. If the degree of shock is severe, immediate treatment must be instituted.

The characteristics of this condition are: listlessness or stupor, irregular gasping breathing, weak and rapid pulse with a low blood pressure and a general loss of sensibility. The face is usualy pale and covered with cold perspiration. The patient often complains of being cold and nauseated.

Treatment of this condition can be summed up in three words: *Heat*; *Position*; *Stimulants.*

1. Keeping the body of an injured person *warm* is most important both in preventing as well as treating shock. All types of additional clothing may be used, external heat with hot water bottles, hot bricks or pads may be used freely, keeping in mind that it is *easy to burn a person who is in shock or unconscious.* Rubbing the limbs is of doubtful value. In examining the person remove no more clothing than is necessary and replace it when through.
2. *Position* of the patient will greatly affect the blood supply to vital organs. *Lay the patient on his back with the head low.* This can best be done by raising the foot of the bed about one foot.
3. *Stimulants* can be used only with conscious patients; they should never be given to bleeding patients or those suffering from a skull fracture, apoplexy or sunstroke. A teaspoonful of aromatic spirits of ammonia in water is very satisfactory or a cup of hot coffee or tea may be used to good advantage.

SNAKE BITES

Treatment for snake bites should be instituted immediately. A tourniquet should be tied around the limb and just above the bite to increase the bleeding. A necktie, handkerchief, or bandage can be used; it should be tight enough to

prevent the blood flowing back through the veins, but not tight enough to prevent the blood flowing in the arteries. In any event it should not be left on for a period greater than one hour.

A cross incision ½ by ½ inch should be made over each fang mark, or preferably to connect the two fang punctures. The cut must be deep enough, ¼ to ½ inch, to insure free bleeding. Suction should then be applied for at least one-half hour. This may be applied by the mouth, glass breast pump, or by heating a bottle and then applying the mouth tightly over the wound. The cooling of the bottle will produce considerable suction.

The patient should be kept quiet and a physician called. Antivenin may be used in the treatment but the free bleeding produced by incision and suction is of far greater value. Whiskey is not a good stimulant for these cases.

INSECT BITES AND STINGS

The proper removal of the sting is very important. This should be done by grasping the sting and removing it whole. A paste made of baking soda or a moist dressing of diluted ammonia water gives relief in most stings or bites. To aid in reducing the inflammation and swelling an ice bag or cold dressing or compress is helpful. If shock is present the usual treatment should be instituted and a physician called as these cases sometimes become serious. For the itching of mosquito or chigger bites calamine lotion is very soothing. For extreme irritation 2% phenol may be added to the lotion.

ARTIFICIAL RESPIRATION

Asphyxia, suffocation or stoppage of breathing occurs most frequently in drowning, electricial shock, and gas poisoning.

The Prone Pressure or Shafer method is the safest and most effective method of treatment. As soon as the person is rescued the mouth should be forced open and any foreign substances such as gum or false teeth, should be removed. As every minute is valuable, begin actual resuscitation without further delay.

Standard Technique:

1. Lay the patient on his stomach so that his face is free for breathing. One arm should be extended over the head, the other arm bent at the elbow so that the face can be turned outward and rested upon the hand.
2. Kneel astride the patient's thighs, with your knees placed at such a distance from his hips as will allow you to exert pressure on the lower ribs as described below. Place the palms of the hands on the small of the back with the fingers on the lower ribs, the little finger just touching the lowest rib, with the thumb and fingers in natural position and the tips of the fingers just around the flank out of sight.
3. With the arms held straight, swing forward slowly so that the weight of your body is gradually brought to bear upon the patient. Do not bend the elbow. This operation should take about two seconds.
4. Now immediately swing backward so as to remove all the pressure completely and suddenly.
5. In two seconds repeat the operation. The movement of compression and release should take about four or five seconds; this should be done at the rate of about twelve to fifteen unhurried respirations per minute.
6. Continue the operation without interruption until natural breathing is restored or until a physician declares the patient dead. Remember, many patients have died because artificial respiration has been stop-

ped too soon—always continue the operation for four hours or longer.

7. Aside from the resuscitation the most valuable aid that can be rendered is to keep the patient warm. After artificial respiration has been started have an assistant loosen the clothing and wrap the patient in any dry clothing that is available. Use hot bricks, pads, heaters or similar means but be sure the person is not burned.

8. When the patient revives he should be kept lying down and not allowed to stand or sit up—this will prevent undue strain on the heart. Stimulants, such as hot coffee or tea, can be given provided the patient is perfectly conscious.

9. At times a patient, after temporary recovery of respiration, stops breathing again; artificial respiration should be resumed at once.

10. Due to the length of time this operation may be kept up, one, two or more operators may be necessary. This change of operators can be made without loss of rhythm of respiration. If this point is remembered no confusion will result when the change occurs and the respiratory count will be kept even.

    The great danger is stopping artificial respiration prematurely. In many cases breathing has been established after three or four hours of artificial respiration and there are instances where normal breathing has been reestablished after eight hours. The ordinary and general tests for death should never be taken; a physician should make several careful examinations at various intervals before the procedure is allowed to be stopped.

Electrical Shock:

The rescue of the victim from a live wire is always dangerous. If a switch is near, turn the current off, but lose no time in looking for one. Use a dry stick, dry clothing or dry rope or other dry non-conductor. Start artificial respiration immediately. Do not regard early stiffening as a sign of death; always keep up the operation for several hours.

Gas Poisoning:

Here again, the rescue is dangerous. A handkerchief tied around the nose and mouth is not a gas mask. The first thing after the rescue is to get the patient in fresh air; this does not mean cold air. The fresh air of a warm room is desirable. If breathing has stopped, is weak or irregular, start artificial respiration. Oxygen is an aid to these patients but does not take the place of artificial respiration. A physician should always be called in these cases as the patient may die even after normal breathing has been established.

Drowning:

Immediately after removal of the victim from the water start artificial respiration by the prone method as outlined. *Do not attempt to remove water from the lungs by any other method.* If it is possible and does not interfere with the maintenance of artificial respiration, see that the wet clothing is removed and the patient made warm.

Other causes of asphyxia such as blows on the head, blows in the abdomen, burial in cave-in, are handled in a similar manner.

INJURIES DUE TO HEAT AND COLD

Burns may be caused by dry or moist heat, electricity, and chemicals. Burns are classified according to the depth to which the tissues are injured:

First degree burns: The treatment is for relief of pain,

Second degree—skin is blistered, as from contact with hot water.

Third degree—skin is destroyed or charred, as from contact with flames.

First degree burns—the skin is reddened, as in sunburn. the skin is not broken so there is no danger from infection. Any substance that will relieve the pain is satisfactory. Any oily substance such as petrolatum (vaseline), olive oil or castor oil is usable. Cold water or soda in water is soothing when immediately applied. It must be remembered that if the burn is at all serious oily substances are not to be applied.

Second degree burns: Here the injury must be regarded as an open wound; only material that is known to be clean can be used. Remove the loose clothing but do not try to remove material that adheres to the skin. Sterile gauze soaked in a solution of Epsom salts, two tablespoonsful to a pint of boiled water, is very good. The dressings should be kept moist and warm until further aid is obtained. Probably the best treatment is with gauze saturated with 2% picric acid solution and applied securely but not tightly. Gauze moistened with 5% tannic acid is also of great value.

Never apply iodine or like substances to a burn and never use absorbent cotton next to a burn. Shock is present, to some degree, in every case of burn.

Third degree burns: These are always serious and require the expert services of a physician. After one of the other procedures has been carried out as an emergency treatment the patient should be warmly clothed, kept in the position for shock treatment and a physician's services obtained.

Chemical Burns:

Burns caused by acids or alkalies should be washed with large quantities of water, preferably not too cold, until the

chemical is thoroughly removed. All clothing should be cut away with scissors. Apply an ointment dressing after the chemical is completely removed and secure a physician's services. Phenol or carbolic acid burns should first be washed with alcohol, if readily available.

Eye burns, from chemicals, require careful attention. The best first aid treatment is to thoroughly flush the eye with clean olive oil, mineral oil or castor oil. If this is not available use water; a drinking fountain that throws a stream is excellent for this purpose. The eye should then be covered with a moist dressing and medical aid secured.

Sunstroke and Heat Exhaustion:

These conditions are both caused by excessive heat, but they differ entirely in their symptoms and treatment.

Sunstroke is a very dangerous condition; it is caused by direct exposure to the hot rays of the sun, especially when the air is moist. The symptoms are:

1. Headache, dizziness, oppression and sometimes vomiting.
2. The skin is hot, dry, and the face flushed.
3. The pulse is rapid and full.
4. The temperature is high, often ranging between 107 and 110 degrees F.

Unconsciousness usually occurs and the body becomes relaxed; however, convulsions may occur.

Treatment: Remove the person to the shade, and a cool place if possible; loosen or remove the clothing. Lay the patient on his back with the shoulders elevated. Apply cold to the head, wet cloths, ice bag, ice. The brain can not withstand the effects of high temperatures.

Cool the body by cold baths for twenty minutes at a time, with brisk massage to the limbs and trunk. Cold wet cloths or ice bags may be used or wrapping the body in a sheet and pouring cold water every few minutes is probably

best. Do not overdo this procedure; stop every few minutes to observe the patient—if the skin again gets hot repeat the treatment. Give no stimulant while patient is unconscious.

Heat exhaustion is caused by exposure to high temperatures as found in boiler rooms, foundries, bakeries, and similar places where heat is excessive, relative humidity high, and air movement deficient. The first signs are dizziness, nausea, and uncertain gait. The face is pale and the body covered with a profuse perspiration which causes the skin to have a cold clammy feel. Breathing is shallow, the pulse is weak, the temperature may be normal or somewhat elevated. Fainting or prostration may become severe. The treatment is to remove the patient to circulating cool air, place him in a recumbent position and let him drink freely cool salt water (one teaspoonful of table salt in a pint of water). A hot water bottle over the abdomen is good for cramps. Call a physician if the exhaustion does not pass away readily.

Frostbite:

Rubbing of a frozen part is not good treatment and rubbing with snow is especially bad as it bruises and tears the frozen tissues and gangrene is apt to develop. Slowly thaw the frozen part by using extra clothing or apply the frozen part to another part of the body until it warms up. Do not expose frozen tissues to a hot stove or radiator.

FRACTURES

A fracture is a broken bone. In a simple fracture the bone is broken but there is no connecting wound from the break in the bone to the skin. In compound fractures there is a connecting wound from the break in the bone through the skin.

Signs and Symptoms of Fractures:

Pain and tenderness at the point of fracture.
Partial or complete loss of motion.
Deformity.
Swelling and later, discoloration occur.
Crepitus or grating may be felt but *no attempt should ever be made to feel this grating.*
Shock is usually present.
Remember all symptoms are not present in every fracture.

Treatment of Simple Fractures:

Splint the patient where he is. Do not transport or move him about until some type of splint is placed in position. Improper handling of a patient may cause the sharp ends of the bones to injure nerves, cut through vessels or even pierce the skin thus producing a compound fracture. In splinting a simple fracture of an extremity, place the limb in as near a natural position as possible by taking hold of the lower part of the limb and pulling gently and steadily. At the same time an assistant should support the part of the limb on either side of the break in order to steady the bone. Then hold the limb in this nearly normal position until splint can be applied. If a traction splint is not available improvised splints can be made of any type of rigid or semi-rigid material. They should be as wide as the limb if possible, always well padded with clothing and long enough to immobilize the next joint in either direction from the fracture. Often pillows, blankets or even newspapers can be used. Pieces of tin or mesh wire make excellent splints. After the splint is in place it should be tied on rather loosely as a fractured limb usually swells considerably within one or two hours. For this reason the limb and the splint adjustment must be examined every twenty minutes to be sure that the circulation is not cut off. Also, if much pain develops, the splints and bandages should be examined.

Following the adjustment of the splint the patient should be placed in a comfortable position and treated for shock. Keep him warm and give him any available stimulant.

Treatment of Compound Fractures:

If severe bleeding is found, check this with pressure between the wound and the heart—then apply a tourniquet. Even where bleeding is not present it is a safe precaution to place a tourniquet loosely around the part so that if bleeding should start, it could be stopped immediately. A tourniquet should never be covered by the bandages or splint—it may be forgotten and not released when necessary.

Traction splints should be applied to compound fractures of the extremities *before* the patient is transported.

If the bone is protruding, do not attempt to push it back in place with the hands or instruments. Apply iodine, *first*, to the exposed bone, *next*, to the parts of the wound about the bone, and *finally*, to the skin over a wide area about the wound. Place a *sterile* dressing over the wound.

After the bleeding has been controlled and the wound dressed, a traction splint is to be applied.

DISLOCATIONS AND SPRAINS

When a bone gets out of place at a joint it is called a dislocation. A sprain is an injury or bruise to a joint. In these conditions the pain is usually severe, marked swelling occurs rapidly and shock is present.

Treatment:

Elevate the part. If the upper extremity—by means of a sling; if the lower extremity—have the patient lying with pillows, coats, or other support, under the leg.

Apply cold applications to the site of the injury to retard the swelling and reduce the pain.

If shock is severe, apply heat to the body and call a physician at once. When in doubt treat the case as a fracture

and apply splints, especially if the patient must be transported.

Never attempt to reduce or correct a dislocation, as permanent damage may be done to the joint.

SKULL FRACTURE AND CONCUSSION OF THE BRAIN

Any person receiving a severe blow on the head or who has been knocked unconscious even for a very short period of time, should be kept quiet until examined by a physician. Head injuries should never be regarded lightly, as frequently the serious symptoms following such an injury do not appear for some hours.

Treatment:

Move only in a recumbent position and handle very carefully.
Apply cold cloths or ice bag to the head.
Keep the patient lying down with the head slightly raised.
Do not give stimulants.
Keep the patient warm.

POISONS

The two principal points to be remembered in the treatment of poisoning cases are:

1. Poisons when diluted are not absorbed as rapidly as when they are in a concentrated form.
2. Clean the stomach out by vomiting or washing, continuing the washing until the fluid returned is clear.

The following fluids are useful in producing vomiting:

Soap suds, use any type soap.
Salt water, or soda water.
Lukewarm water.
Dishwater.
Milk, especially for corrosive poisons.

Give four to seven glassfuls, preferably lukewarm. Tickling the throat with the finger, after drinking of the fluid, will usually induce vomiting. A large dose of Epsom salts may safely be given after the stomach is cleaned out.

For carbolic acid (phenol) poisoning give soap suds with Epsom salts. For the corrosive poisons such as bichloride of mercury give milk or the whites of eggs.

For sleep inducing drugs the patient must be kept awake by physical exercise; strong coffee can also be used.

For strychnine poisoning do not give stimulants; keep the patient as quiet as possible; wash the stomach with weak solution (steel blue color) of potassium permanganate.

Most cases of poisoning show signs of shock so that heat is usually beneficial and artificial respiration may become necessary.

COMMON EMERGENCIES

Foreign Bodies in the Ear:

The only safe method is to syringe the ear canal with lukewarm water. If the object does not come out, drop in a little olive oil or mineral oil and consult a physician. Never use pins or wire to dislodge these objects as there is great danger of seriously injuring the ear. Insects in the ear can usually be killed by dropping in a little oil and then washing the ear with a syringe.

Foreign Bodies in the Nose:

These usually present no immedate danger. Gentle blowing of the nose may be tried; if unsuccessful drop in a little olive or mineral oil and consult a physician. Any attempt to remove the objects with forceps or wire usually causes more swelling and lodges the body more securely.

Foreign Bodies in the Eye:

They are very frequent and are attended by considerable danger. The first thing is not to attempt to remove the ob-

ject with the fingers or to rub the eye. Close the eye for a few minutes until the worst of the irritation is over, then grasp the upper lid lashes and elevate the lid; repeat this process a few times. Many cases so treated will be washed clear by the tears.

Where the above method fails a search must be made under the upper lid. To examine under the lid, have the patient look down, place the thumb near the edge of the lid and with the other hand raise the lashes. Wipe the object with the corner of a clean handkerchief or irrigate the eye with water that has been boiled, using a small rubber ear syringe to direct the stream of water directly into the eye. This is a safe and easy procedure to try.

If the object is embeded in the eye or lid, or if there is difficulty in attempting to remove the substance, close the eye and apply a small bandage, just sufficient to keep the eye closed, and consult a physician. *Never* attempt to use a knife, tooth pick or similar agent to remove an object from the eye. The eye is precious and must not be damaged by ill chosen procedures.

Pain in the Abdomen:

May be due to a variety of causes, many of which may be serious. In any case where pain occurs over all or part of the abdomen with nausea and vomiting and accompanied or followed by pain and tenderness in the lower right part of the abdomen, *appendicits* must be suspected.

Always put these cases to bed at once and call a physician.

Do not give a cathartic or laxative.

Do not give any food.

Unconsciousness:

May be complete or partial. Frequently it is impossible to determine the cause and treatment must be along general lines. An unconscious person with odor of alcohol on his breath should not always be considered drunk. A drunk per-

son may not have an alcoholic breath. It is wise always to consider the possibility of apoplexy or stroke, diabetic coma, uremic coma, and skull fracture in every case of unconsciousness. In examining an unconscious patient, look carefully for the stoppage of breathing, poison, bleeding, or sunstroke, as special treatment for these must be given at once.

Treatment:

1. Lay the patient on his back with the head and shoulders slightly raised.
2. Apply cold cloths or ice pack to the head.
3. Insist on absolute quiet; do not move the patient unless very necesary and then do so very carefully.
4. Have sufficient cover to keep him warm.
5. Use no stimulants until the patient is awake and some cause for the condition is found.
6. Call a physician.

Fainting:

Usually allow the patient to lie where he falls, if he can be made comfortable. Lower the head and shoulders by elevating the hips. Loosen the tight clothing. Sprinkling the face with cold water, and inhalations of ammonia or smelling salts are beneficial.

Convulsions or Fits:

Undress or loosen the patient's clothing and place him in a hot bath always keeping, if possible, a cold cloth on the head. The bath water should be hot but be careful not to burn the patient. To test the temperature place your bare elbow in the water for one minute; if it is comfortably hot and does not burn the skin, it can be used safely. A tablespoonful of mustard may be added to each gallon of water if it is available. If no tub is available wrap the person in a heavy blanket or hot towels wrung out of water. The pack or bath should be used for thirty minutes and repeated if

necessary. Following the bath the patient should be placed in a warm bed and given an enema. Always call a physician.

DISINFECTION

Disinfection must be carried out in every case of contagious disease to prevent further transmission. The principle underlying disinfection is the killing of the germs causing the disease. The two types of disinfection which concern us in handling patients are:

1. *Concurrent Disinfection.* The prompt treatment and disposal of all infected material from the patient during his illness. Also the thorough cleaning of all surroundings of the patient.

2. *Terminal Disinfection.* The measures taken after recovery or at end of quarantine to destroy or properly clean all things with which the patient has had contact.

Methods:

For discharges from the nose and throat use sputum cups or gauze and burn.

For urine and feces; keep 2% cresol in urinals and bedpans. After use, add twice as much 2% cresol as infected material. Mix thoroughly, allow to stand one hour, empty into sewer.

For remnants of food,—burn.

For dishes and eating utensils,—boil after use.

For thermometers,—a separate one for each contagious case. Wash with soap and water and keep in alcohol.

For wash basins, bedpans, urinals, thorough cleansing with soap and water followed by 2% cresol.

For sheets, pajamas, towels and bedding,— boil or immerse in 2% cresol solution.

For mattresses and pillows—thorough exposure to air and sunlight, or steam sterilization.

For bed and floors—thorough scrubbing with hot water and soap.

For room—exposure to the air and sunlight.

For attendants—use gowns and masks and provide facilities for washing the hands with warm water and soap.

SECTION VIII.

USEFUL INFORMATION

CALCULATION OF RATES

The following formulae may be used to calculate the various rates required for statistical, sanitary, and venereal reports:

1. *Admission Rates.*

a. Daily Admission Rate $= \dfrac{\text{Cases admitted}}{\text{Strength}}$

b. Daily Admission Rate per 1000 strength $=$

$$\text{Cases admitted} \times \frac{1000}{\text{Daily Strength}}$$

c. Annual Rate per 1000 strength by weeks$=$

$$\text{Week's cases} \times 52 \times \frac{1000}{\text{Mean Strength for the Week}}$$

d. Annual Rate per 1000 strength by 4 weeks period$=$

$$\text{4 weeks' cases} \times 13 \times \frac{1000}{\text{Mean Strength for the Period}}$$

e. Annual Rate per 1000 Strength by 5 weeks period$=$

$$\text{5 weeks' cases} \times 10.4 \times \frac{1000}{\text{Mean Strength for the Period}}$$

f. Annual Rate per 1000 Strength by months$=$

$$\text{Month's cases} \times 12 \times \frac{1000}{\text{Mean Strength for the Month}}$$

2. *Non-effective Rate.*

$$\text{Non-effective rate per 1000 strength} = \frac{\text{No. days lost from duty}}{\text{No. days in period}} \times \frac{1000}{\text{Mean Strength for the Period}}$$

3. *Prophylactic Rate.*

$$\text{Prophylactic Rate per 1000 strength per month} = \text{No. prophylactics administered} \times \frac{1000}{\text{Av. Daily Strength}}$$

WATER

Measurement of Stream Flow.

Formula:

$$\text{Depth} \times \text{width} \times 4/5 \text{ surface velocity per hr.} \times 7.48 = \text{gallons per hr.}$$

Example:
Average depth of stream = 6 inches.
Average width of stream = 4 feet.
A chip of wood travels along stream:
25 feet in 20 seconds
or
75 feet in 1 minute
or
4500 feet in 1 hour = surface velocity.
4/5 of 4500 feet=3600 feet per hr = mean velocity.
Calculation: $\frac{1}{2} \times 4 \times 3600 \times 7.48 = 53{,}856$ gallons per hour stream yield.

Turbidity:

5 ppm=just noticeable in a drinking glass.
10-15 ppm=objectionable-cloudy.
100 ppm=muddy appearance.
500-1000 ppm=opaque.

Application of chlorine or chlorine compounds.

1 part of chlorine in a million parts of water equals one part per million (1 ppm).

8-1/3 lbs. of liquid chlorine in a 1,000,000 gallons of water equals 1 ppm.

Calculation:

1 gallon of water weighs 8-1/3 lbs.

1,000,000 gallons of water weigh 8,333,333 lbs.

$$1/1{,}000{,}000 \text{ of } 8{,}333{,}333 = \frac{8{,}333{,}333}{1{,}000{,}000} = 8.33 \text{ lbs.}$$

of chlorine required for 1 ppm.

25 lbs. ordinary Calcium Hypochlorite (33 1/3% available chlorine) or 12½ lbs. grade A Calcium Hypochlorite (70% available chlorine) in 1,000,000 gallons of water= 1 ppm. chlorine.

1 lb. of ordinary Calcium Hypochlorite in 12 gallons of water = a 1% solution of bleach.

Calculation:

1 gallon water weighs 8-1/3 lbs.
12 gallon water weighs 100 lbs.
1/100 of 100 = 1% solution.
1/100 of 100 = 1.
1 lb. bleach in 100 lbs. water=1% solution of bleach, or 0.3% solution of chlorine.

Ortho-tolidine solution.

Dissolve 1 gram of o-tolidine, melting point, 129 degrees C., in 1 liter of dilute hydrochloric acid (100 cc. concentrated acid dilute to 1 liter):

HOUSING

Air space in barracks:

60 square feet per man.
1800 - 2200 cubic feet fresh air per man per hour while sleeping.
3000 cubic feet fresh air per man per hour in hospital.

Comfort zone - Clothed Person.

Temperature—68°F. Relative humidity—50%. Air movement—100 ft. per minute.

Air velocity.—2 feet per second just noticeable.
4 feet per second definite draft, drifts cigarette smoke.

Window space.

1-1.5 square feet of inlet and outlet per 10 men, at outside temperature of 50°F.

7 square feet window space per 60 square feet floor space if windows are on both sides of squad room.

Calculation of space.

Length (ft.) × width (ft.) = area in square feet.

Length (ft.) × width (ft.) × depth (ft.) = space in cubic feet.

$$\text{Acres} = \frac{\text{length in yds.} \times \text{breadth in yds.}}{4840}$$

Thermometer Readings.

0°C = Freezing.	32°F = Freezing.
100°C = Boiling.	212°F = Boiling.

To read Fahrenheit from Centigrade:

$$F = \frac{9\,C}{5} + 32$$

To read Centigrade from Fahrenheit:

$$C = \frac{5\,(F - 32)}{9}$$

WASTE DISPOSAL

Latrine Construction.

Straddle trench—16 feet per 100 men.

Deep pit latrine using standard QM box—2 boxes per 100 men.

Pipe urinal—5 pipes per 100 men.

Urine soakage pit—4' x 4' x 4' per 200 men in favorable soil.

Waste Disposal (kitchen).

Less than one week—Burial.

Semi-permanent camps—Field appliances:

Soakage Pit—4' x 4' x 4' for 200 men in favorable soil.

Barrel grease trap—1 per 200 men.

Cross trench incinerator.

METRIC SYSTEM

The metric, or decimal, system is based on a unit of length, the meter (M), from which the unit of weight, the gram (Gm.), and that of capacity, the liter (L.), are derived. The liter (L.), the unit of capacity is a cube, each edge of which measures 10 centimeters.

Weight:-The gram is the primary unit.

10 Milligrams (mg)=1 centigram (cg)=0.1543 troy grains
10 centigrams=1 decigram=1.543 troy grains
10 decigrams=1 gram=15.432 troy grains
10 grams=1 decagram=0.3527 avoirdupois oz.
10 decagrams=1 hectogram=3.5274 avoirdupois oz.
10 hectograms=1 kilogram=2.2046 avoirdupois lbs.
10 kilograms=1 myriagram=22.046 avoirdupois lbs.
10 myriagrams=1 quintal=220.46 avoirdupois lbs.
10 quintals=1 tonne=2204.6 avoirdupois lbs.

Length: The primary unit is the meter.

10 millimeters (mm) = 1 centimeter (cm) = 0.3937 inch
10 centimeters = 1 decimeter = 3.937 inches
10 decimeters = 1 meter = 39.37 inches
10 meters = 1 decameter = 393.7 inches.
10 decameters = 1 hectometer = 328 feet 1 inch
10 hectometers = 1 kilometer = 0.62137 miles
10 kilometers = 1 myriameter = 6.2137 miles.

Capacity: The primary unit is the liter.

10 milliters (ml) = 1 centiliter = 0.338 fluid ounce
10 centiliters = 1 deciliter = 0.845 liquid gill
10 deciliters = 1 liter = 1.0567 liquid quarts
10 liters = 1 decaliter = 2.6417 gallons
10 decaliters = 1 hectoliter = 2 bushels, 3.35 pecks
10 hectoliters = 1 kiloliter = 28 bushels, 1½ pecks.

AVOIRDUPOIS WEIGHT

Ounces		*Pounds*		*Hundredweight*		*Ton*
16	=	1				
1,600	=	100	=	1		
32,000	=	2000	=	20	=	1

LINEAR MEASURE

Inch		*Foot*		*Yard*		*Rod*		*Mile*
12	=	1						
36	=	3	=	1				
198	=	16½	=	5½	=	1		
63,360	=	5,280	=	1,760	=	320	=	1

SQUARE MEASURE

Sq. Inch.		*Sq. Foot*		*Sq. Yard.*		*Sq. Rod.*		*Acre*		*Sq. Mile*
144	=	1								
1,296	=	9	=	1						
39,204	=	272¼	=	30¼	=	1				
6,272,640	=	43,560	=	4,840	=	160	=	1	=	1/640

CUBIC MEASURE

Cubic Inch		*Cubic Foot*		*Cubic Yard*
1,728	=	1		
46,656	=	27	=	1

LIQUID MEASURE

Gill		*Pt.*		*Qt.*		*Gal.*		*Bl.*		*Hhd*
4	=	1								
8	=	2	=	1						
32	=	8	=	4	=	1				
1,008	=	252	=	126	=	31½	=	1		
2,016	=	504	=	252	=	63	=	2	=	1

DRY MEASURE

Pint		*Quart*		*Peck*		*Bushel*
2	=	1				
16	=	8	=	1		
64	=	32	=	4	=	1

CIRCULAR MEASURE

60 seconds—1 minute.
60 minutes—1 degree.
90 degrees—1 quadrant.
360 degrees—1 circumference.

Popular Measures:

1 drop = .05 cc.
1 teaspoonful = 4.0 cc.
1 tablespoonful = 15.0 cc.
1 teacup = 125.0 cc.
1 glass = 200 cc.
1 canteen = 900 cc.
1 canteen cup = 700 cc.
1 canteen cap = 6 cc.

Percentage Solution:

1 part in 100 parts = 1% solution.
10 parts in 100 parts = 10% solution.
5 grains in an ounce = 1% solution.

Approximate Equivalents:

1 pint = 16 fluid ounces = 500 cc.
1 quart = 32 fluid ounces = 1000 cc. = 1 liter.
1 liter = 1-1/18 liquid quarts = 9/10 dry quart
1 ounce = 30 cc.
1 gallon (liquid measure) = 231 cubic inches = 8.33 avoirdupois pounds = 58,333 grains = 3782 grams.
1 gallon (dry measure) = 268.8 cubic inches.
1 cubic foot = 7.48 liquid gallons = 6.428 dry gallons.
1 cubic foot = 4/5 of a bushel.
40 cubic feet = 1 ton (shipping).
128 cubic feet = 1 cord (wood).
2150 cubic inches = 1 standard bushel.
1 British Imperial gallon = 4.54 liters.
1 U. S. gallon = .83 British gallons.
1 milligram = 1/64 grain.
1 gram = 15.5 grains.
1 kilogram = 2.2 pounds.
1 pound avoirdupois = 1.22 pounds Troy.

Steam Pressure:

Steam at 0 lbs. pressure has a temperature of 212°F.
Steam at 5 lbs. pressure has a temperature of 228°F.
Steam at 10 lbs. pressure has a temperature of 240°F.
Steam at 15 lbs. pressure has a temperature of 251°F.
Steam at 20 lbs. pressure has a temperature of 260°F.
Steam at 40 lbs. pressure has a temperature of 287°F.

DISEASE	INFECTIVE AGENT	SOURCE
Meningococcic Meningitis	Diplococcus intracellularis meningitidis	Discharges of mouth and nose
Measles	Filterable virus	Discharges of mouth and nose
Diphtheria	Diphtheria bacillus	Discharges of throat and nose
Scarlet Fever	Streptococcus scarlatinae	Discharges of nose, throat, ears, abscesses, wounds.
Septic sore throat	Streptococcus epidemicus	Discharges of throat and nose. Udder of infected cow.
Influenza	Undetermined	Discharges of throat, mouth and nose.
Mumps	Filterable virus	Discharges of mouth
Poliomyelitis (Infantile paralysis)	Undetermined, probably filterable virus.	Discharges of nose, throat and bowels.
Typhoid Fever	Typhoid bacillus	Bowel discharges and urine
Dysentery bacillary	Flexner-Y bacillus, Shiga-Kruse bacillus.	Bowel discharges

TRANSMISSION AVENUE OF	INCUBATION PERIOD	*a. ISOLATION b. QUARANTINE.
Contact: direct indirect	2 to 10 days, usually 7.	a. 14 days after onset. b. 14 days.
Contact: direct indirect	10 days.	a. 2 weeks after onset. b. 2 weeks after cessation of symptoms in last case.
Contact: direct indirect Food: milk milk products	2 to 5 days.	a. Until cultures are avirulent. b. Until cultures are avirulent.
Contact: direct indirect Food: milk milk products	2 to 7 days, usually 4.	a. 28 days from onset. b. 7 days from last exposure.
Contact: direct indirect Food: milk milk products	1 to 3 days.	a. Course of disease. b. 7 days.
Contact: direct indirect	24 to 72 hours.	a. Acute stage. b. None.
Contact: direct indirect	12 to 26 days, usually 18.	a. While swelling lasts. b. None.
Contact: direct indirect Food: milk	Uncertain, probably 3 to 10 days, usually 6.	a. 3 weeks from onset. b. 14 days from last exposure.
Water Food Contact: direct	7 to 23 days, usually 10 to 14.	a. Until 2 successive stool cultures are negative. b. None.
Water Food Contact: direct indirect	2 to 7 days.	a. 2-6 weeks after recovery. b. None.

*Note: a. Isolation of patient.
b. Quarantine of contacts.

DISEASE	INFECTIVE AGENT	SOURCE
Dysentery amoebic	Endamoeba histolytica	Bowel discharges
Dengue	Filterable virus	Blood of man
Malaria, three types, tertian, quartan aestivo-autumnal	Plasmodium malariae, three types	Blood of man
Plague, two types: bubonic, pneumonic	Bacillus pestis	Blood of man and rodents, rats commonly.
Typhus Fever, epidemic	Rickettsia, prowazeki	Blood
Relapsing Fever	Spirochetes several varieties	Blood
Rocky Mountain Spotted Fever	probably Rickettsia,	Blood of infected animals and infected ticks.
Tularemia (Rabbit fever)	Bacterium tularense	Wild rabbits, chipmunks, ground squirrels and quail. Flies. Ticks.
Undulant Fever	Brucella melitensis	Milk of cow and goat. Bowel discharges and urine: cow. goat. hog.
Tetanus (Lockjaw)	Tetanus bacillus	Animal manure Soil Street dust.

AVENUE OF TRANSMISSION	INCUBATION PERIOD	*a. ISOLATION b. QUARANTINE
Water Food Contact: direct indirect	20-95 days.	a. Prove patient is no longer a carrier. b. None.
Bite of infected mosquito, Aedes egypti	4 to 5 days.	a. During course of disease. b. None.
Bite of infected mosquito, Anopheles.	Varies; usually 14 days in tertian type.	a. During duration of disease. b. None.
Bite of infected rat flea. Accidental, by bites of infected animals. Bedbugs. Flies. Contact: direct	3 to 14 days.	a. During course of the disease. b. 7 days.
Infected lice	5 to 20 days, usually 12.	a. During course of the disease. b. 2 weeks.
Infected lice and ticks. Contact: direct.	3 to 12 days, usually 5 to 7.	a. During course of the disease. b. 2 weeks.
Infected ticks and mites.	3 to 10 days, usually 7.	a. During course of the disease. b. None.
Infected flies and ticks. Contact: direct.	24 hours to 9 days, usually 3.	a. During course of the disease. b. None.
Food. Milk. Contact: direct.	6 to 16 days.	a. During period of communicability. b. None.
Inoculation. Wound infection.	4 days to 3 weeks	a. None. b. None.

*Note: a. Isolation of patient.
b. Quarantine of contacts.

POINTS TO BE CONSIDERED IN SANITARY INSPECTIONS OF CAMPS

1. *Mess hall.*

Is it screened?

Are flies present? What measures are taken for fly prevention?

Are mess tables scrubbed after each meal?

Are tables so constructed that center board can be removed for cleaning?

Are food particles found between boards on tables?

Is floor clean? What method of cleaning is used to prevent dust?

Are mess attendants clean as to person and clothing?

Are dishes and tableware clean and free from grease?

What provision is made for washing dishes? Is soapy water and rinse water boiling at the time dishes are washed?

2. *Kitchen.*

Is it screened?

Are flies or roaches present? What insect control measures are used?

Are work tables and meat cutting blocks scrubbed after using?

Is menu posted? Is diet varied? Is it well balanced?

Is food served in an appetizing manner?

Is hot food served hot?

Is cold food served cold?

Are kitchen utensils clean and free from grease?

What provision is made for washing pots and pans? Is rinse water boiling at the time pots and pans are washed?

Is provision made for mess personnel to wash their hands after using the latrine?

How is garbage handled in the kitchen?
Is floor kept clean? What method of cleaning is used to prevent dust?
Are the food handlers examined according to regulations?
Is the food handlers' list posted in kitchen?

3. *Garbage disposal.*

Is garbage rack clean? Are food particles found on the rack or on the ground under and around the rack?
Do lids fit tightly on garbage cans?
Are garbage cans properly cleaned after emptying?
Are fly traps being used at the garbage rack? Are they properly baited?
What system of garbage disposal is used?
If by incineration is the incinerator adequate?
Is the area around the incinerator kept clean?
What method of disposal is made of liquid wastes?
Is the grease trap kept cleaned?
Is the soakage pit adequate?
Are cans burned and flattened out before being placed on dump?

4. *Food Storage.*

Is ice box temperature maintained at 45°F. or lower?
Is the ice box or cooler clean? If a cooler house is used is it screened?
Is meat suspended so that there is free circulation of air on all sides?
Is cured meat stored so that there is free circulation of air on all sides?
Are vegetables stored in bins off the floor with free circulation of air on all sides?
Are the bins clean and is the floor under the bins clean?
Is milk supplied in bottles?
Is milk kept at the proper temperature?

5. *Water Supply.*

Is water source properly protected from contamination?
Is the method of chlorination properly supervised?
Is the water chlorinated satisfactorily?
Is the water examined bacteriologically at frequent intervals?
Is the water free from objectionable color, odor, and taste?

6. *Showers.*

Are there sufficient shower heads?
Is hot water available?
Are duck boards used? Are they scrubbed daily?
Is shower room kept clean?
Are benches available for undressing?
What provision is made for prevention of spread of skin infections?

7. *Latrines.*

Are latrines screened if not enclosed in building?
Are latrines sprayed daily?
Are seats and urinals scrubbed daily?
Are lids kept closed at all times?
Is the latrine fly proof?
Is the latrine floor clean?
If water carriage system of sewage disposal is used, are flush boxes and toilets all in working order?
What system of disposal of sewage is used?
If septic tank, is it adequate?
What method of disposal of effluent is used?
If tile field, is there evidence of over-charging the field?
If by dilution, is the stream flow or other body of water adequate at all times for proper dilution?

8. *Barracks.*

Are barracks well lighted?
Is ventilation adequate?
Are drafts noticeable?
Are floors clean? What method of cleaning is used to prevent dust?
Is floor space adequate for the number of men in the building?
Is heating adequate and uniform throughout the rooms? Are heat deflectors used in disseminating the heat if stoves are used?
Are beds or bunks free from bed bugs?
Is bed clothing clean?
Is bedding aired twice a week?

THE POINTS AT WHICH PRESSURE MAY BE EXERTED ON MAIN ARTERIES

For the artery to the head and neck:

1. In the neck just to the side of the windpipe, against the backbone.
2. Just in front of the ear, against the skull.
3. About an inch forward from the angle of the jaw, where a large branch crosses the jaw bone.

For the artery to the shoulder and arm:

4. Behind the inner end of the collar bone against the first rib.
5. On the inside of the upper arm, half-way between the shoulder and the elbow.

For the artery to the lower limbs:

6. In the groin as it passes over the pelvic bone. However, the point about a hands breadth below the groin on the inside of the thigh is used for the tourniquet.

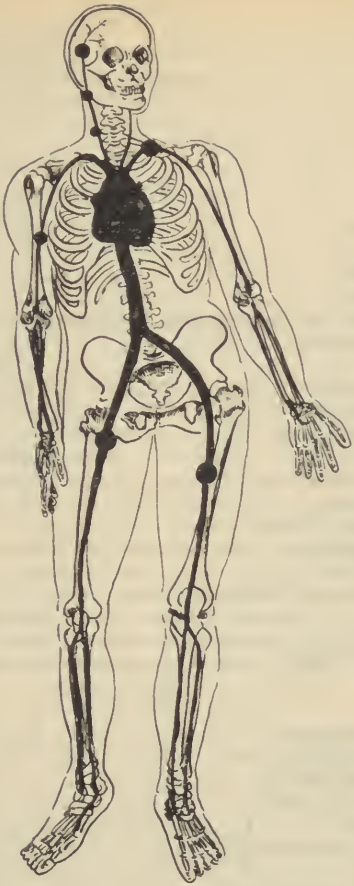

Fig. 65. Schematic outline showing course of principal arteries. Circles indicate points where pressure can be applied to control hemorrhage.

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